# THE SOUTHERN FOREST RANGERS COLLEGE MAGAZINE

42 ANNUAL 1966

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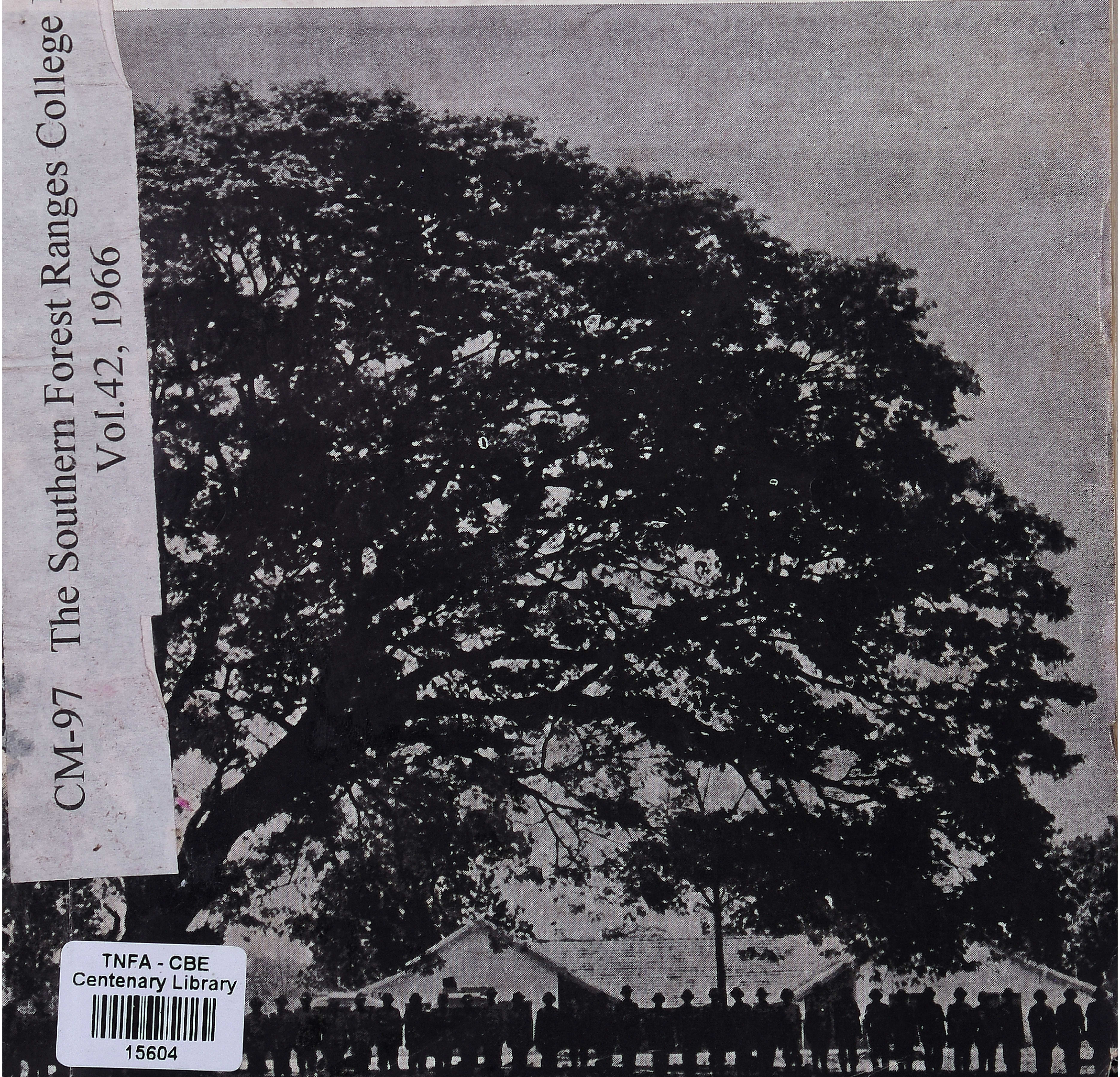

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THE
SOUTHERN FOREST RANGERS COLLEGE MAGAZINE

Vol. 42 ANNUAL 1966

# ABOUT OURSELVES

**1965—'67 RANGERS COURSE :**

The total number of students joined the 1965-67 Rangers Course commencing from 1—11—65 are as shown below:

| | | | |
|---|---|---|---|
| Andhra Pradesh ... | 13 | Madhya Pradesh ... | 37 |
| Gujarath ... | 4 | Maharashtra ... | 46 |
| Kerala ... | 24 | Ceylon (Colombo Plan) ... | 1 |
| Madras ... | 16 | Tripura ... | 2 |
| | | Total ... | 143 |

**TOURS : SENIORS :**

The first tour which was a North Indian tour in Jan./Feb. 1966, included camps at Allapalli, Nagri, Agra, Dehra Dun and Delhi. The second tour was in April/May, 1966 and places of camp were Virajpet, Nilambur and Coonoor. The last tour in July, 1966 which was mainly Field Engineering and Weapon Training was at the Madras Engineer Group and Centre, Bangalore. There was a short camp at Mysore on return.

**JUNIORS :**

The first tour in Jan./Feb. 1966 included the three usual camps at Topslip, Benneri and Sadivayal. The Second tour which fell in April/May, 1966 included Kodaikanal, Gudalur (Lower Camp), Nagercoil and Punalur camps. The third tour in July, 1966 covered Trichirapalli, Neyveli and Chingleput camps. A short tour was arranged for the Junior Rangers to Mangarai for the Survey Prac. Exam. from 13—10—66 to 28—10—66.

**ANNUAL ATHLETIC SPORTS :**

The Annual Athletic Sports [illegible] held on 9—1—66 (Sunday). Dr. J. Thuljaram Rao, Director, S[illegible] Institute, Coimbatore, presided and Srimathi Thuljaram Ra[illegible] Prizes to the winners. The Championship cup was won by S[illegible] 1964-66 Rangers Course, from Gujarat State.

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**MARATHON RACE**

The Annual Marathon Race, extending over a distance of about 7 miles was run by the students on 19—3—1966. Shrl C. H. Mohd. Kunhi, Student, 1965-67 Rangers Course from Gujarat State, came first in the Race.

**CONVOCATION :**

The Annual Convocation of the College was held on 31—10—1966, in a specially erected pandal. Shri N. Chenchurama Naidu, Minister for Forests, Andhra Pradesh, presided over the Convocation and distributed the Prizes and certificates to the students. Out of 108 students, one student was awarded Honours certificate, 102 students were awarded Higher Standard and 5 were awarded Lower Standard Certificates.

**LOGGING TRAINING CENTRE :**

Basic Logging Training Centre was established in the Southern Forest Rangers College Estate, Coimbatore. in October 1966. This is a unit under F. A. O. of the United Nations.

**MEN AND MATTERS :**

Miss. Sharon Ann Sharrett, an American Farm Delegate visited this Institution on 4th Dec. 1965. She was taken round this College estate and Gass Forest Museum attached. Mr. B. Sivaraman, I. C. S., Secretary to the Government of India, Ministry of Food and Agriculture, New Delhi, visited the College and Museum on 9—1—66.

Shri T. N. Shrivastava, President, Forest Research Institute and Colleges, Dehra Dum, visited the College on 13—2—66.

Mr. A. L. Cameron, Senior Research Officer, Territory of Papua and New Guinea and the State Silviculturist, Madras State, Madras, visited the Southern Forest Rangers Coilege and Museum attached on 10—4—66.

Mr. Sven-Ingvar Sjostedt, F. A. O. Logging Project Co-Director and Mr. Carlson, Basic Logging Expert, Logging Training Centre, visited the College on 11-5-66.

Mr. R. M. Gorrie, I. F. S. (Retd.) an eminent Forest Officer and at present Editor of the Scottish Forester of Edinburgh visited the College and Museum attached and Research Laboratories on 1st and 2nd June, 1966. Dr. R. M. Gorrie addressed the staff and students of this College on 2-6-66 at 4-30 P. M.

His excellency Sardar Ujjal Singh, Governor of Madras, accompanied by Sardarini Ujjal Singh, paid a visit to the Southern Forest Rangers College and Research Centre on 1-9-1966. They were shown round the College, Museum and Research Laboratories of various branches between 12.00 and 12.30 P. M.

Prof. Bojnansky of Czeckoslavakia, visited the College and Museum attached on 19—10—66.

*— Editor.*

# Annual Sports

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The Annual Sports meet of the College Athletic Association was conducted on 9—1—1966. The proceedings began with a march-past of the competing athletes, at which, Dr. J. Thuljaram Rao, Director, Sugarcane Breeding Institute, Coimbatore, who was the Chief Guest of the evening, took the salute. An interesting day's programme was gone through and the large gathering of invitees enjoyed every bit of it. There was a keen competition for the individual Championship between Shri M. A. Sayed and Shri H. V. Chaudhary and the former, who ultimately got it by the narrowest of margins, was awarded the Richmond Rolling Cup for the best athlete.

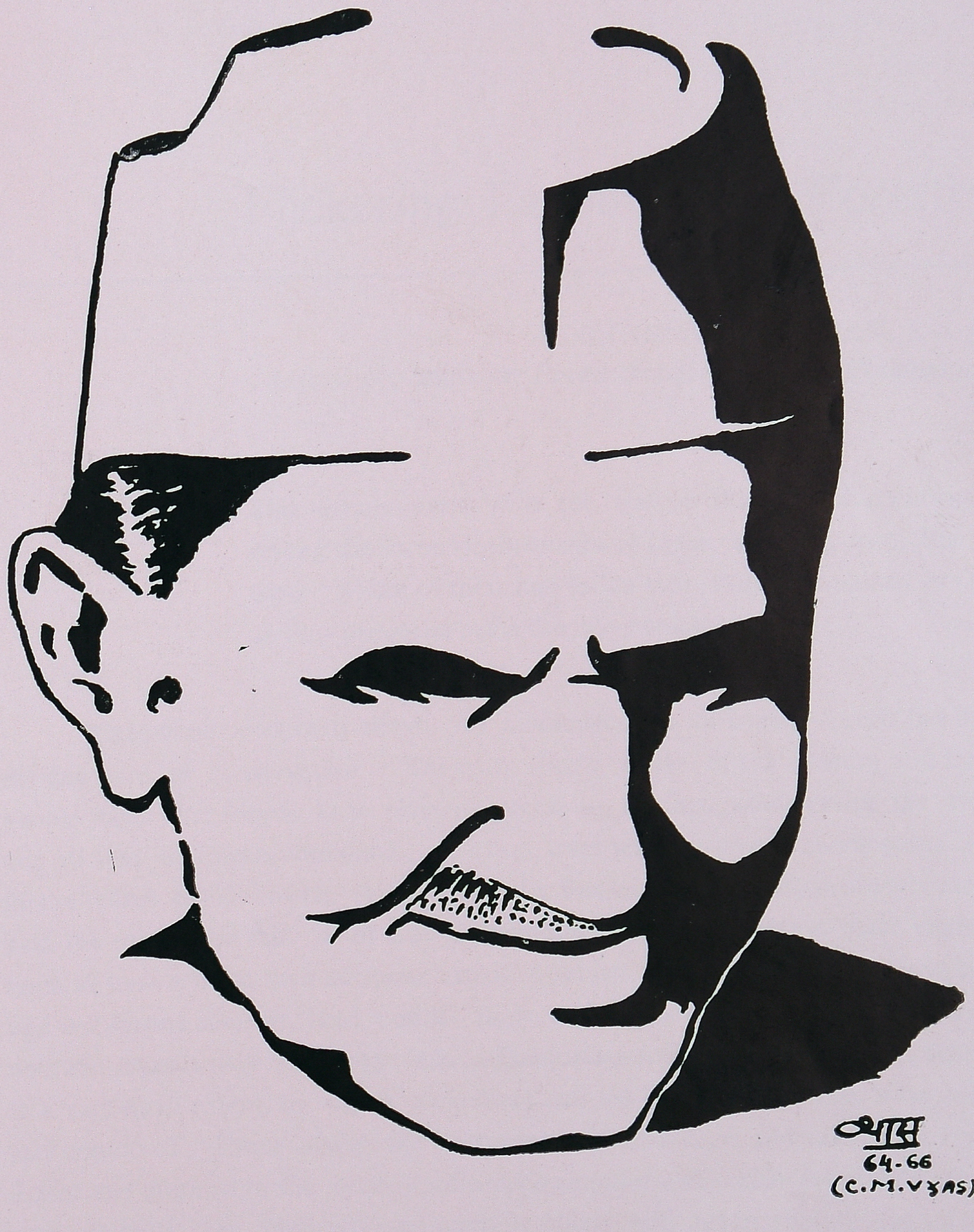
Sports over, Mr. M. B. Peter, Principal, Southern Forest Rangers College, welcomed the Chief Guest and others and Mrs. Thuljaram Rao distributed the Prizes. Mr. S. N. Krishnamurthy, Officer-in-charge of Sports Section proposed a vote of thanks.

Results are as follows :

## SOUTHERN FOREST RANGERS COLLEGE, COIMBATORE.

### LIST OF PRIZES AWARDED ON 9—I—1966 - ANNUAL ATHLETIC SPORTS - 1966 -

| S.No. | Event | *Prize Awarded to Ist Prize Name* | *Prize Awarded to IInd Prize Name* |
|---|---|---|---|
| 1. | 100 Metres Dash | B. D. Patidar | M. A. Sayed |
| 2. | Putting the Shot | H. V. Chaudhari | K. Papa Rao |
| 3. | Servants Race | S. Achuthan | R. Kannian |
| 4. | 110 Metres Hurdles | M. A. Sayed | C. G. Singam |
| 5. | (a) Staff Race (slow cycle) | R. Saravanan | S. Chaudrasekharan |
| | (b) Staff Race (Spoon & Lime) | D. Rajammal | A. G. Rajeswari |
| 6. | Discuss Throw | Keshavan Namboodari | H. V. Chaudhari |
| 7. | 200 Metres Dash | M. A. Sayed | B. D. Patidar |
| 8. | High Jump | H. V. Chaudhari | P. Subramanyam |
| 9. | 400 Metres Race | M. S. Joy | C. G. Singam |
| 10. | Children's Race (Boys) | Balakrishnan | Avinash Ketkar |
| 11. | Children's Race (Girls) | Sanjeevani Ketkar | R. Bhatnagar |
| 12. | Pole Vault | R. K. Achutanand | R. Viswanathan |
| 13. | 800 Metres Race | C. M. M. Kunhi | C. G. Singam |
| 14. | Javelin throw | H. V. Chaudhari | E. K. Namboodari |
| 15. | 3500 Metres fast cycle race | B. H. Hiremath | P. Subramaniam |
| 16. | Long Jump | G. Vidhyasagar | M. A. Sayed |
| 17. | 1500 Metres Race | C. M. M. Kunhi | J. D. Joseph |
| 18. | Sack Scrlmmage | Prasad Reddy | P. Shivaji |
| 19. | Slow Cycle Race | C. M. M. Kunhi | L. B. Mishra |
| 20. | Hammer throw | P. I. Jacob | G. S. Pandey |
| 21. | 4 × 100 Inter-Divisional Race | Senior A | Junior A |
| 22. | Gymkhana Race | Mrs. Ketkar & Mr. Bhole | Mr. Balu & Mrs. S. Rao |
| 23. | Hop Step and Jump | M. A. Sayed | K. Madan Mohan |
| 24. | Tug of war - Inter-Divisional | Junior II Batch ('B') | Senior 'B' |
| 25. | Richmond Rolling Cup for Best Athlete | M. A. Sayed | 21 points |
| 26. | Pentathlon – Uberoi cup – Tie between | M. A. Sayed & E. K. Namboodari & | H. V. Chaudhari |
| 27. | Sankunni Menon rolling up - best house in track and field: | V house | (Muthanna house) |
| 28. | Laungani rolling cup – best house in field events: | Tie between VI house "Dutta house" | 4 Muthanna house |
| 29. | Seetha Bai rolling cup – best house in track events: | V & VI - V house | (Muthanna house) |
| 30. | Fancy Dress | R. Satyanarayan Rao | Chinniah |
| 31. | 4 × 100 Metres Invitation relay race | | |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(C.M.VYAS)

# Flickering Favourites in Forestry

K. SHANMUGANATHAN, I. F. S..
Instructor, Southern Forest Rangers College, Coimbatore.

(*Summary:* This article deals with the species that have found favout among the forest departments of India, in spurts, from time to time. Many of these had fallen into disfavour almost as fasr as they appeared but a few have stuck on.)

Right from very early times, the administration of Indian forests has had the key note of conservation. The early Hindu rulers of the country and their people held the forests in a revered esteem — in fact worshipping the trees and all that the forests contained. Cutting trees was considered sacrilegious and this religious belief among the people of a then thinly populated country along with the conception that all of God's creations have equal rights to exist, enabled them to have a more than adequate extent of forests. Came a serious of invaders, and our forests came to hold amidst their midst maruaders and outlaws, along with the savants they had always held. The forests naturally had to suffer, though to a very small extent, by way of clearances and the like, but still they were zealously conserved. From about the 18th century onwards, a general decline in the extent and more so in the quality of certain popular and useful forest tree species seems to have been observed and certain rulers had taken special measures to protect and conserve them. The religious and sentimental beliefs had begun to

lose their grip and so the men in charge had to resort to punitive measures to protect the forests and some specially selected trees from complete disappearance. It is said that during the regime of a certain ruler in South India, the punishment meted out to persons that cut a Sandal, Teak or Red Sanders trees, was to cut off the hands that brought the tree down !

With the advent of the British in the 19th century, Indian Forest administration was based on the principles of European forest management — conservation of forests on the basis of sustained yield by ensuring adequate restocking of the worked forests by natural means. Over-exploitation of the forests set in, even during the early British administration of the forests and when it was realized that dependence on natural regeneration is not likely to maintain adequate supplies of more species, especially Teak, efforts to raise plantations of these species were launched in the middle of the last century and when they were found successful, larger areas were planted with these species and artificial regeneration techniques were extended to more species. Ultimately, artificial regeneration became almost the rule from the beginning of this century (even early in a few cases), in the forests of the peninnsular and extra-peninsular regions of the country (except for Sal, which is generally managed under the uniform system) while the the forests on the Himalayas and Sub-Himalayas are stlll regenerated by natural means.

Having achieved good success with artificial regeneration methods, there was a trend, a healthy one to begin with at least, to plant up a few more indigenous species by these means and also to introduce exotics, most of them useful ones, in forestry operations. — Introduction of exotics is nothing new to our forestry for even a century earlier (1840's), *Eucalyptus globulus* and the Australian wattles were introduced in the Nilgiris and later on, *Cryptomeria japanica* in Bengal. While most of the plantations of the different species, exotics as well as indigenous ones, have generaily succeeded, a close scrutiny of the schemes in particular will reveal a definite preference to particular species at particular stages or periods of our planting activities.

Since the commencement of this century, different species have received our attention and almost held sway to the exclusion of others, in our activities at different times and in the process, some species are found to have been planted over a wide range of localities, often beyond the realm of natural possibilities and utility. To begin with, it was Teak. While the fact that it is the king amongst timbers is unchallanged, extending it on plantation scale to localities not suited for it, certainly was not needed. To-day we can see vestiges of such planting activities of teak in areas receiving less than 50 centimeters of annual rainfall, with only a couple of rainy months and a very severe summer or on soils bordering almost on desert sand, heavy laterite or on high altitudes transgressing into the sub-montane forests etc., etc. It is not that the foresters of those days were not aware of its silvicultural requirements. They were, but the remarkably successful results achieved by a well-developed and almost fool-proof technique, kindled their enthusiasm, a bit too much as one sees now in retrospect. They did it on good faith and with great hope but unfortunately the hopes of these pioneers proved to be dupes. We must however concede to their benefit that they had no previous experiences to start with. But have the succeeding generations become wiser on this record of experience.

In fact subsequent efforts with different species reveal that little lessons have been learnt from this. By about the 1930s *Cassia siamia* was planted on a large scale all over the forests of the country, probably because of the ease with which it could be propagated. At the initial stages of its planting, very little was known about the utility of this species, but still it was raised on a large scale. Later on it was found to be of very little value. In fact after some painstaking, arduous research, it was inferred that the charcoal out of it could be used for the producer gas plants which provided the power for some motor vehicles during the last world war ! Producer gas plants vanished as hastily as they appeared. While its capacity to come up and establish under very inhospitable conditions is useful for anti-erosion and afforestation of areas where nothing else come up, this species on a plantation scale, has proved to be a waste.

Then, in the 1940s, came the wave of *Prosopis juliflora* – another hardy species capable of thriving even under the most unfavourable conditions. This was originally taken up for planting up and afforesting deserts and other sandy tracts, mainly perhaps, to fix shifting sand. This purpose it has served nobly and because it is unpalatable, escaped the depredations of cattle, including goats and to a lesser extent, camels. But, its easy propagation led on to large scale of planting along river and canal banks, from where it spread naturally by dispersal of seeds through water. Unfortunately the public also took to it and raised it extensively. This proved to be a bad mistake, as this species was found to be a bad drain on the soil fertility as it is an avaracious "grabber" of all soil nutrients, much to the detriment of all other plants including the cultivated crops on agricultural fields. In addition to this, this is of very little value otherwise. In fact, at present this species is being eradicated in parts of South India - not much in the forests - with painstaking and costly operations ! Its capacity to come up intensively to the exclusion of many other forest species, retarded (if not totally prevented) the setting in of the forces of natural ecological succession and the forests did not improve in quality. Hence, in forestry, this species has been given the "good.bye", with the great haste that it deserves, except in the desert sands !

Then in 1956-57, there was a mild "invasion" of *Dalbergia sissoo* in the plantations of dry fuel forests in the arid zones of Madras State. A very useful species in its normal habitat in the northern India, its rate of growth in the dry zones of Madras was very poor though it exhibited a remarkable capacity to struggle and survive and thus helped to maintain the percentage of stocking in the plantations ! It was observed that its growth stagnated after three years. This species was hence found to be not quite suitable for a bulk of these tracts and dispensed with. Since all these plantations were raised with mixed species, the areas were covered up alright.

Close on its heels came the next wave - the species being what is popularly known as *Eucalyptus* hybrid (Mysore variety). Genuine doubts have been raised by quite a few as to whether this is a hybrid at all. while many others feel that this

species is the result of hybridization generally among *Eucalyptus rostrata, E. tereticornis* and *E. citriodors*. Whatever it be, this is another hardy tree species that can be raised easily on plantation scales. This is now known to be only *E. tereticornis* and referred to as the "Mysore Gum." This appears to be capable of coming up and growing well under a wide range of climatic conditions and other factors of locality and hence has found lot of favour amidst the foresters of our country. Starting from tha nucleus in Chickaballapur in Mysore, it has now been spread almost at the pace of an epidemic, from Kanyakumari to Himachal Pradesh and perhaps even beyond ! While full advantage should be taken of the capacity of this species to come up and establish under conditions too inhospitable for many other tree species, there does not seem to be any justification at all to extended plantations of this species all over the forests of our country, particularly over sites capable of supporting other more useful tree species. Instances are not wanting where fertile forest areas supporting more valuable stands of the Tropical Evergreens, Moist deciduous types etc., have been cleared extensively and planted up with this - the species of the modern "Pulp age" ! The general argument put forth in favour of this species is that it is a very quick growing species and as such five to six crops of this can be harvested during the rotation period of other hardwoods such as Teak and the like. It is also suggested that the future is for laminated wood, chip board, dust board etc. and not for timber as used at present and that this species with possible quick rotation should be useful for the manufacture of the products enumerated. But in our country, with all the difficulties we are facing now, with restricted import of the required machinery, the inability to produce the machines ourselves, the inadequacy of the power required to run such factories and the high cost of labour and overhead charges, it is extremely unlikely that we would be producing in any near future. chip board, dust boards, laminated wood and the like, at a cost within easy reach of thc bulk of the population. Even today plywood costs more than ordinary wood, to be used in constructional purposes and few can well afford them. As much, common timbers such as the more expensive teak and rosewood and less expensive ones such as Sal, Laurel, *Pillamarudu* (Terminlia paniculata), *Vengai* (Pterocarpus marsupium), *Venteak* (Lagerstroemia lanceolate and many others are bound to be used commonly any many more decades to come. In the face of this, it does seem premature and some what hasty, to take up large scale conversion of natural forests to plantations of this species. Even for a product like "Masonite" it is said to be used in lesser quantities and not the principal species in Australia. Its utility for pulping is also of doubtful nature. Throughout the world, it is reported to be used in somewhat

large quantities only in Brazil (Sao Paulo). The South India Viscose Factory in Madras State have found it economically not worthwhile to use this for viscose purposes. Not many paper mills in our country have shed off their preferences for traditionally established plant species, such as bamboos. reeds, *salai* etc., for pulping purposes. Perhaps the argument can be that they have to changc their preferences in the new context of non-availability of these species, but the 'Mysore gum' does appear to be the solution. There are many other species of Eucalyptus better suited for pulp-manufacture: There are also many other species of *Eucalyptus*, of much better utility value than *Eucalyptus tereticorins*, that are capable of growing better in the different tracts of varying factors of locality, in our country. It is to be borne in mind, however that Eucalyptii in general :

(a) draw a lot of moisture from soil,

(b) impoverish the soil and reduce soil fertility,

(c) add little to the soil as their leaf-litter is toxic,

(d) will not permit the natural processes of plant succession, as they are themselves of an invading nature, and

(e) by their great capacity for natural regeneration may swamp out other useful natural species of the locality.

Thus, while converting the less useful and denuded forests to artificial stands of more useful forests with selected species is a vital necessity, the choice of such species has to be made with great caution and only after careful scrutiny of its usefulness and silvicultural requirements. Monoculture need not necessarily be carried to the extreme limit nor should personal preferences be extended to large tracts.

While new ventures in Forestry practices are most welcome, traditional conservatism should not be cast off with any undue haste.

# Training of Elephants

**S. GOPALAN**

Forest Veterinary Officer, Coimbatore

In India elephants are mostly engaged in forest areas for timber-dragging. Hence they are given special training for the above work.

After training in the Kraal is completed the new-capture has to be taken out of the Kraal; for assistance, for the first week, two or three *Kumkis* may be required to escort the new-capture to the stream and back; while remaining inside the Kraal alone, hobbles and leg-chains are tied on the animal for a few days. On the first day, a rope may have to be put round the neck of the animal and the other end has to be held by a *Kumki*; the *mahout* and *cavady* make the new-capture hold the stick, and tempting it with plenty of sugar-cane pieces, slowly lead the animal to the stream, give a bath, then tie the animal outside the *Kraal* for a few hours, lead it into the *Kraal* again and provide plenty of fodder. After training like this for a few days, say a week, the animal is taken to a good grazing area in company with, or under the escort of one or two domesticated elephants, allowed to graze well during day-time for about a fortnight or a month, and daily after the evening bath and feed, it is tied near the camp and given plenty of cut fodder. Subsequently the elephant will be allowed to go about grazing both during day time and night, after receiving good and invigorating bath and grain-feed twice daily.

Now the first aim is to make the new-capture get the normal healthy condition and settle well under domestication and foster a love and affection for the

staff who look after it. This will, ordinarily take a year or a year and a half, and in big captures, even two years. The next step is to train it daily for two or three hours, either for baggage purposes with small loads or for light timber dragging. This is aimed at during the second and third year, under domestication. During the fourth year the elephant is put to light work daily for five or six hours; from the fifth year onwards the working capacity is gradually increased. As regards the management of elephants and extraction of work from them, a long range policy is aimed at. No doubt, in certain cases, the animals would appear to have come round very well and easily with training and they might be quite normal in health and for anybody and everybody it may be tempting to extract a good lot of work from it even within a year and a half or two, after domestication; but this policy of doing too much too soon is to be curbed; for putting elephants to heavy work early after training was detrimental to their health, and it proved fatal in a short period. in several instances, whereas if they are carefully tended managed and maintained by starting to work the animals in slow degrees, and gradually increasing the working capacity; year after year, in course of a few years, they prove to be very useful workers and turn out very good work in timber yards, for several years.

As regards the *Kraals*, a few words have to be mentioned. They are strong and big cage-like wooden structures, intended to house new-captures for purpose of training. Each *Kraal* may have two or three rooms and each room is intended to keep one elephant at a time. Generally, each room has one strong pillar at the middle of each side. Altogether one room will have 8 pillars each having a base of 15 inches or 37·5 cms. square; the length of pillar has to be 22 feet or 6·7 metres; of this length six feet or 1·83 metres will form part of the foundation, inside the earth. About two feet or 60 cms. above the earth level, a platform 12 feet × 12 feet or 3·66 metres × 3·66 metres is constructed in between the eight pillars, with planks, one foot or 30 cms. wide and 3 inches or 7·5 cms. thick, leaving an interspace of about an inch or 2·5 cms. between each plank, all round, between the 8 pillars bars 8 inches or 20 cms. broad and 4 inches or 10 cms. thick form a binding wall, at a height of 21 inches or 52½ cms. above the level of the earth, and over these bars are placed planks 3 inches or 7·5 cms. thick and one foot or 30 cms. broad, and

fixed with 7 inches or 17½ cms. spike nails. In each pillar, rectangular holes are scooped at different intervals, in order to admit the passage of cross bars 6 inches 15 cms. wide and 4 inches or 10 cms. thick, and 16 feet or 4·87 metres long between the three pillars on each side; the interspace between the medial lines of cross-bars on each side is usually about 1½ feet or 45 cms. Zinc sheet roofing with a layer of grass over it is generally provided. The entrance to each room is fixed with four pieces of rough squared timber 12 feet × 1 foot × 6 inches or 3·66 metres × 30 cms. × 15 cms.; the slope forms a gradient 1 in 6.

Underneath the wooden platform the ground level is cement plastered and provided with drains all round. The material used for the *Kraal* may be either teak or any other hard-wood.

Wild elephants take longer to "break in" than those born in captivity and the shock of being captured seriously affects their health and nervous systems. Older animals in fact are very badly shaken. The older the animal, the more it resents captivity, and the greater is the probability of its dying of a broken-heart. Youngsters 4 to 6 years are usually obedient in about a fortnight, and even an animal of about 18 to 20 will be moderately submissive to the attendants by the end of a month. Each stage in the education of a nearly full grown animal, takes longer than younger animals, and it is generally considered that at least 18 months will be required before new captures 7 feet or 213·4 cms. at the shoulder-level (the usual minimum height for timber-working animals) are capable of beginning profitable works in the forests. In any case, it is inadvisable to work new animals at all strenuously until they have recovered from the shock of capture, adopted themselves to their new conditions of life and fully regained their former or original standard of physical fitness. It is to be noted that elephants require plenty of green fodder, such as bamboo-leaves, grass, ficus-twigs etc. when handled at their standings, they generally spoil and waste about half the quantities of fodder supplied, or even more. Therefore allowing margin for this wastage, elephants whether they be new-captures or working-animals, may be allowed the following scale of green fodder daily.

| Sl.No. | Elephants of height between | Quantity of green fodder. |
|---|---|---|
| 1. | 8′6″ & 9′0″ or 259.1 & 274.3 Cms. | 1000 to 1200 Lbs. or 450 to 540 Kg. |
| 2. | 8′0″ & 8′6″ or 243.8 & 259.1 Cms. | 800 to 1000 Lbs. or 360 to 450 Kg. |
| 3. | 7′6″ & 8′0″ or 228.6 & 243.8 Cms. | 700 to 800 Lbs. or 320 to 360 Kg. |
| 4. | 7′0″ & 7′6″ or 213.4 & 228.6 Cms. | 600 to 700 Lbs. or 275 to 320 Kg. |
| 5. | 6′6″ & 7′0″ or 198.1 & 213.4 Cms. | 500 to 600 Lbs. or 225 to 275 Kg. |
| 6. | 6′0″ & 6′6″ or 182.9 & 198.1 Cms. | 400 to 500 Lbs. or 180 to 225 Kg. |
| 7. | 5′6″ & 6′0″ or 167.6 & 182.9 Cms. | 300 to 400 Lbs. or 135 to 180 Kg. |
| 8. | 5′0″ & 5′6″ or 152.4 & 167.6 Cms. | 200 to 300 Lbs. or 90 to 135 Kg. |
| 9. | 4′6″ & 5′0″ or 137.1 & 152.4 Cms. | 100 to 200 Lbs. or 45 to 90 Kg |
| 10. | 4′0″ & 4′6″ or 121.9 & 137.1 Cms. | 50 to 100 Lbs. or 23 to 45 Kg. |
| 11. | 3′6″ & 4′0″ or 106.7 & 121.9 Cms. | 25 to 50 Lbs. or 12 to 23 Kg. |

Simultaneously with imparting training for the animals, the earliest opportunity is to be availed to start giving them cooked grain-feed; gradually the ration is increased for them. Also 15 to 20 leaves of *Caryota Urens* may suffice for an average elephant, a day. Ficus branches may be roughly about a thumb's thickness.

The following scale of diet may be suitable for the elephants stationed in the forest areas, for departmental works such as dragging timber, transport of food grains and other materials from place to place, Joy-ride in sanctuaries etc.

| Sl. No. | Height of Elephants between | Diet during working period | | | | | Diet during rest period e. g. hot weather rest | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Horse-gram. | Ragi-flour. | Rice. | Common salt. | Jaggery. | Horse-gram. | Ragi-flour. | Rice. | Common salt. | Jaggery. | |
| | | Kg.G. | Kg.G. | Kg.G. | G. | G. | Kg.G. | Kg.G. | Kg.G. | G. | G. | |
| 1. | (a) 8 feet 6 inches and 9 feet. or<br>(b) 259.08 and 274.32 Cms. or<br>(c) 2.59 and 2.74 metres. | 5.500 to 6.500 | 9.000 to 11.000 | 3.000 | 200 to 250 | 50 | 3.000 | 6.500 to 8.000 | 3.000 | 100 | 50 | |
| 2. | (a) 8 feet and 8 feet 6 inches. or<br>(b) 243.84 and 259.08 Cms. or<br>(c) 2.44 and 2.59 metres. | 4.500 to 5.500 | 8.000 to 9.000 | 3.000 | 200 | 50 | 2.250 to 3.000 | 5.500 to 6.500 | 3.000 | 100 | 50 | |
| 3. | (a) 7 feet 6 inches and 8 feet. or<br>(b) 228.60 and 243.84 Cms. or<br>(c) 2.29 and 2.44 metres. | 3.750 to 4.500 | 4.500 to 6.500 | 3.000 | 175 to 200 | 50 | 1.750 to 2.250 | 4.500 to 5.500 | 3.000 | 75 to 100 | 50 | |
| 4. | (a) 7 feet and 7 feet 6 inches. or<br>(b) 213.36 and 228.60 Cms. or<br>(c) 2.13 and 2.29 metres. | 2.750 to 3.750 | 4.500 to 6.500 | 3.000 | 150 to 175 | 50 | 1.500 to 1.750 | 3.500 to 4.500 | 3.000 | 75 | 50 | |
| 5. | (a) 6 feet 6 inches and 7 feet. or<br>(b) 198.12 and 213.36 Cms. or<br>(c) 1.98 and 2.13 metres. | 2.000 to 2.750 | 3.750 to 4.500 | 3.000 | 125 to 150 | 50 | 1.000 to 1.500 | 3.000 to 3.500 | 3.000 | 50 to 75 | 50 | |
| 6. | (a) 6 feet and 6 feet 6 inches. or<br>(b) 182.88 and 198.12 Cms. or<br>(c) 1.83 and 1.98 metres. | 1.000 to 2.000 | 2.750 to 3.750 | 3.000 | 100 to 125 | 50 | 0.500 to 1.000 | 2.500 to 3.000 | 3.000 | 50 to 75 | 50 | |

| Sl. No. | Height of Elephants between | Diet during working period | | | | | Diet during rest period e. g. hot weather rest | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Horse-gram. | Ragi-flour. | Rice. | Common salt. | Jaggery. | Horse-gram. | Ragi-flour. | Rice. | Common salt. | Jaggery. | |
| | | | | | | | Kg.G. | Kg.G. | Kg.G. | G. | G. | |
| 7. | (a) 5 feet 6 inches and 6 feet. or<br>(b) 167.64 and 182.88 Cms. or<br>(c) 1.68 and 1.83 metres. | under training for light baggage work. | | | | | 0.000 to 0.500 | 2.000 to 2.500 | 3.000 | 50 | 50 | |
| 8. | (a) 5 feet and 5 feet 6 inches. or<br>(b) 152.40 and 167.64 Cms. or<br>(c) 1.52 and 1.68 metres. | Too young therefore not to be worked. | | | | | Nil. | 1.500 to 2.000 | 2.500 to 3.000 | 50 | 50 | |
| 9. | (a) 4 feet 6 inches and 5 feet. or<br>(b) 137.16 and 152.40 Cms. or<br>(c) 1.37 and 1.52 metres. | Too young for being put to work. | | | | | Nil. | 1.000 to 1.500 | 2.000 to 2.500 | 50 | 50 | |
| 10. | (a) 4 feet and 4 feet 6 inches or<br>(b) 121.92 and 137.16 Cms. or<br>(c) 1.22 and 1.37 metres. | Too tender and young for being put to work. | | | | | Nil. | 0.500 to 1.000 | 1.500 to 2.000 | 25 | 50 | |
| 11. | (a) 3 feet 6 inches and 4 feet. or<br>(b) 106.68 and 121.92 cms. or<br>(c) 1.07 and 1.22 metres. | Too tender and young for being put to work. | | | | | Nil. | 0.000 to 0.500 | 1.000 to 1.500 | 25 | 50 | |

Half the quantities of grains and Ragi-flour mentioned above will have to be got cooked before day break for the morning feed of elephants, and the remaining half before sunset for their evening feed. Pregnant elephants and cow-elephants with calves at heels need daily 100 to 125 grams of mineral mixture and a hundred to 125 Ml. of Veterinary Vitamin oil. Elephants which have delivered calves receive for about six months from date of delivery about ten to twelve Kilograms of rice, 125 grams of salt and six to eight coconuts daily. During this period the issue of horsegram is stopped. In the absence of *Ragi* and Rice, other grains such as *Cholam* (Bajra) maize or wheat can be substituted; but it is necessary to have these grains broken into smaller particles and then used for cooking purposes. Gingely oil is now and then prescribed to elephants in doses of 125 to 250 Ml. daily along with feed.

For purpose of checking the cooked grain-feed, wooden moulds are used. One Kilogram of ragiflour when cooked will form a mould of size 12.7 cm x 12.7 cm. x 15.4 cm. One kilogram of cooked horsegram will make up a mould of 12.7 cm. x12.7 cm. x 14.0 cm. and half-a-kilogram of cooked rice will fill in a mould of 12·7 cm. x 12·7 cm. x 12·6 cm. Usually horsegram will require about six to eight hours for cooking well and after that it is advisable to have the same put in a wooden mortar and pounded well, before feeding it to the elephant. Iron vessels are generally used for purpose of cooking food-grains. For elderly elephants it may be necessary to reduce the quota of ragi flour suitably.

As a preventive measure, against multiplication of worms in elephant camps, the dung passed by the elephants in their standings requires to be collected and dumped into the dung-pit, both morning and evening and burnt. The pit may be 6′ x 6′ or 1.83 metres x 1.83 metres and situated about 50 yards or 46 metres away from the camp, and away from the stream. During the rainy season, the pit may be covered with a thatched roof, and as it may not be possible to burn the dump, it may be covered with a layer of earth 2″ thick. When one pit is filled completely, a new one may be dug and the old one covered with earth completely. Elephants ailing from indigestion or diarrhoea should not be brought near the cooking-shed or feeding ground. The ailing animals should be stopped at least fifty yards away and then attended to.

As a precautionary measure against bolting away, the elephants must invariably be hobbled when feeding in the camp, or on any occasion when the mahout is off the animals. The leg-chain fastened to one of the hind legs should never be removed from the animal while riding and marching, the lengthy chain shouid be folded into two or three parts, and put on the back of the animal; when left for grazing in the jungle, the leg-chain will have to be allowed to trial on the ground. It will be safe for various reasons that every elephant has a bell tied round its neck. If an animal is restive or unreliable with strangers, it will be the duty of the attendants of such animals to warn strangers. When strangers are present, the mahout should always be near his animal and carefully watch it. Bells will be of use to trace the animal while grazing in the forest or to trace them when they bolt away; when elephants are let out for grazing after feed is over, the attendants should make it a point to take their animals to places where there is plenty of fodder.

# Baby Bereaved - by Man Eater

H. RAJAGOPAL SHETTY,
Assistant Instructor

Sethuram, the Bungalow Watcher of the Rest house at Nagri is that type of man who are generally called " Markhandeyas " or " Ever-greens ". He is a local man of the interior forest village, short in build, wiry and desiccated in look. His skin is sun-burnt. Years have left innumerable wrinkles on his body. But all the weathering factors seem to have given up. For, since years, he has changed little.

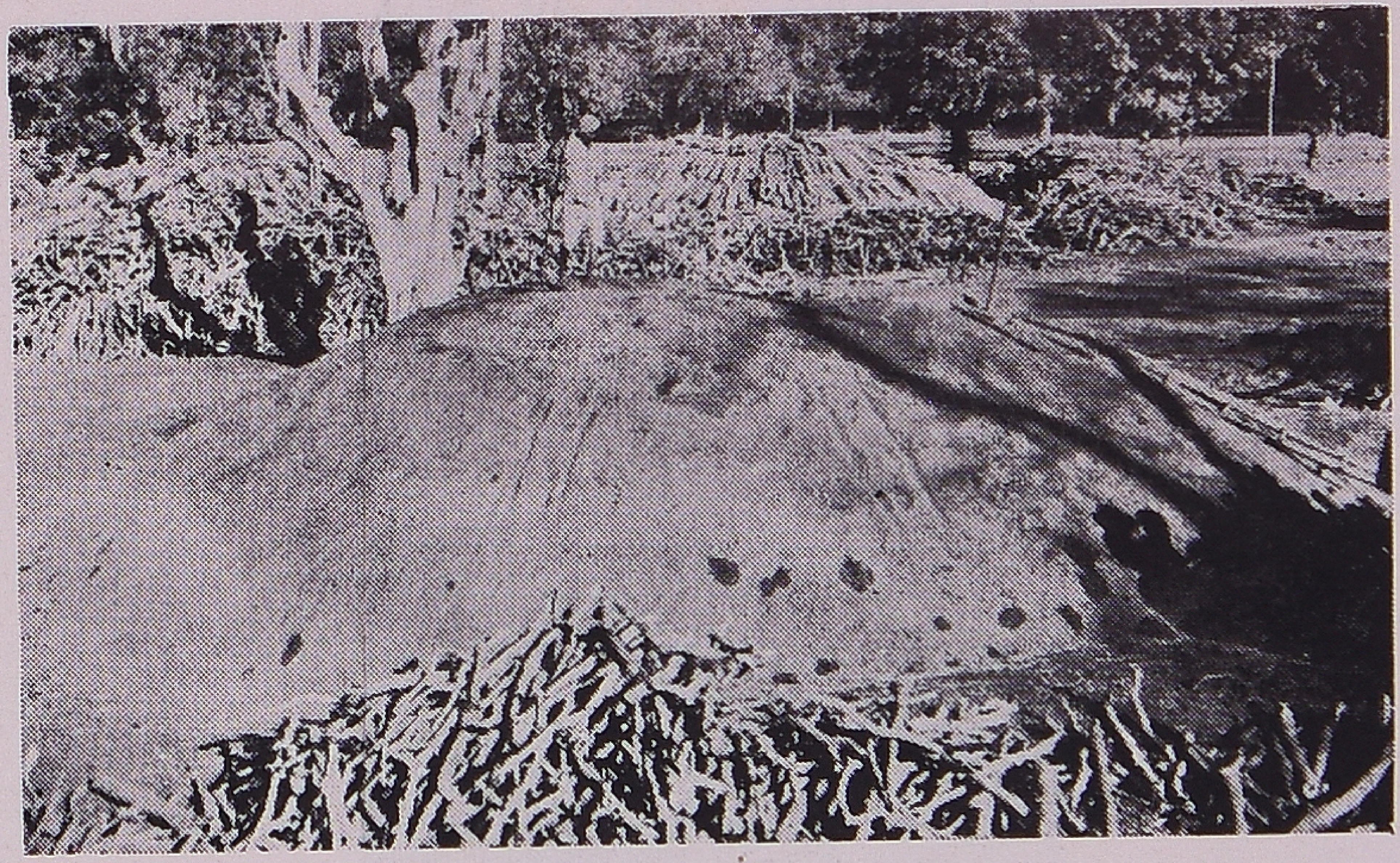
With a resigned distant look and a saintly smile, he appeared contented in spite of his hand to mouth existence. He was seen attending to his duties regularly and in between he was seen to move about with a tiny baby, which was mostly crying. I often wondered how India's population is still around 500 million, when couple over fifty like Setharam are still productive. It was more in humour I started questioning about his family particulars. Also, it was only then I could guage the depth of sorrow under the sardonic smile on his face.

His only daughter was given in marriage when still young, to a villager on the border of Bastar. Last year she conceived and old parents became immensely happy. When the child was born they walked all the way to see their daughter and grand daughter.

On that fateful evening the mother went with the other damsels of the village to bring water from the stream adjoining the village, little suspecting the fate awating her. It was when she was returing with a potfull of water, that the man eater appeared on the bed of stream. The rest of the girls ran in panic and reached the village to tell the story of horror. Bits of clothes sticking to the bushes were all that was seen of her in the adjoining jungle.

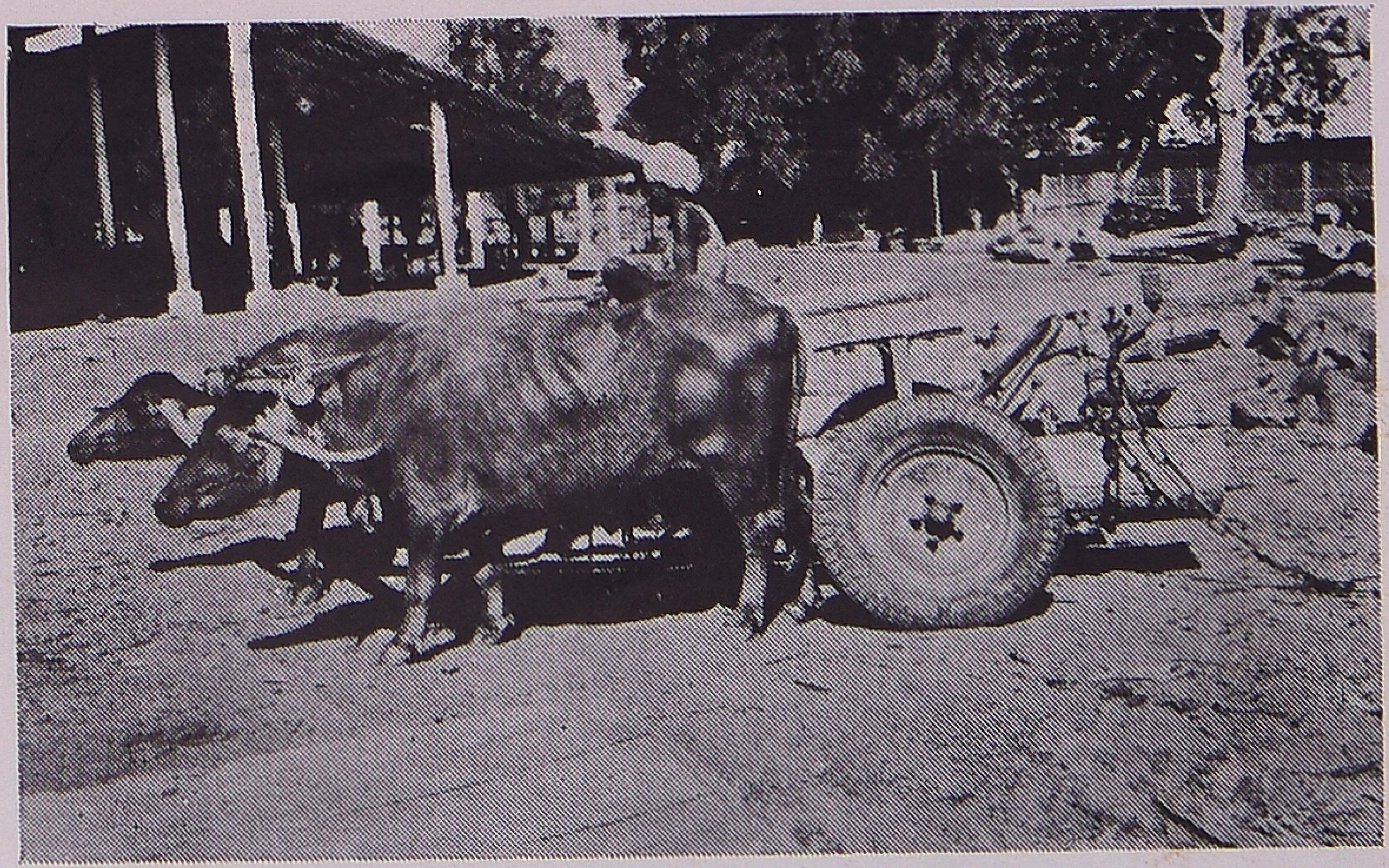
It was how the poor child, hardly three months in age. was in the care of the grand parents. All it wanted was milk, which was hard for the old man to procure.

Bereaved Baby – by Man-eater Place – Nagri.



Charcoal Kiln – Choudampalli, Allapalli.

Carriage by Men. South Raipur Dn.



Transport of Timber in the round, within Saw Mill premises by Burma Cart — Allapalli.

Sleeper Conversion – South Raipur Dn.

Mechanical Thinning of Sal Plantation
– South Raipur Dn.

Soil Conservation Work – Nalotha Nalla
– Enroute Mussorie.

View of Dak Patharboom.

# Artificial key, based on vegetative characters, for the identification of some important trees of the Forests of Walayar and Boluvampatti

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**ABSTRACT :**

An artificial key, based *only* on the vegetative characters, for the identification of 137 important trees met with in the forests of Walayar and Boluvampatti has been given.

**INTRODUCTION :**

Identification of trees in the forests is often met with great difficulties because of the variations in the flowering periods of different species. Hence the specimen collectors and Forest Officers have felt the need for a key, based mainly on the vegetative characters, to fecilitate identification of the forest trees at any time, especially when the flowers are not available. Even though such a key may not be important for the systematist, yet, experience and long association with the students of the Forest College and Forest Officers, and a close study of the vegetative features of the different trees mentioned below, have shown that the vegetative characters can be relied upon to a great extent to identify the plants of particular localities where the original natural forest growth remains without any addition of any exotic species, since each one of the individual plants do possess some distinguishable character. The following key for the important forest trees of Walayar and Boluvampatti was prepared after a close study of these plants in these areas for a number of years, which, it is hoped,

will obviate the difficulty in identifying these trees on the spot, even if there are no flowers. This key may also be found suitable to other areas as well where these trees occur, in other words, where the climatic and ecological factors and the vegetation are identical to these areas.

Flowering and fruiting periods have also been indicated for the trees mentioned in the key. The nomenclature, as far as possible, has been brought uptodate. Synonyms have also been given.

**LOCALITY:**

The forests of Walayar form part of the Palghat Division of Kerala State, and forests of Boluvampatti form part of Coimbatore Division of Madras State. Both the forests are situated on the northern side of the Coimbatore - Palghat highway, on a hill, the Walayar region being the southern slope and the Boluvampatti region being the northern slope of the hill. The hill is in the from of a horse-shoe surrounding the Boluvampatti valley, opening eastwards. Rainfall varies on both the slopes, being less in Walayar and more in Boluvampatti. In Walayar the flora consists more of deciduous species whereas in Boluvampatti it consists more of evergreen species.

**MATERIAL AND METHOD:**

137 important species found in both the forest areas of Walayar and Boluvampatti were studied closely for many years and the present key was prepared after an analysis of their vegetative features, for identifying them.

The key is primarily to be used with the specimen in the field. Only the pair of contrasting vegetative characters are mentioned under each serial number in the key. Unless otherwise stated, the characters mentioned refer to mature parts, and the references are to average features and not to extremes. It is intented that the species should be checked by means of the artificial key from the very begining and continued until a suitable key to the character found in specimen is reached. In other words, one has to read the pair of contrasting characters given under serial number 1, and has to satisfy as to which of the characters are agreeable to the specimen in question, and follow the serial number indicated against that character/characters till the identification of the specimen is arrived at.

*The Key*

| Serial number | Details of character/characters | Serial number to be referred |
|---|---|---|
| 1. | Leaves simple/unifoliate (with one leaflet) ... ... | 2 |
| | Leaves compound (with 2 or more leaflets) ... ... | 89 |
| 2. | Leaves alternate ... ... ... | 3 |
| | Leaves not alternate ... ... ... | 65 |
| 3. | Trees with milky juice ... ... ... | 4 |
| | Trees without milky juice ... ... ... | 14 |
| 4 | Trees armed ... ... ... | 5 |
| | Trees unarmed ... ... ... | 7 |
| 5. | Stem joints twisted spirally; Flowers Dec-Jan; Fruits Dec-Jan. subglobose, 13 mm diam. **Euphorbia tortillis** Rottl. | |
| | Stem joints not twisted; stipular spines in pairs from conical spirally arranged tubercles ... ... | 6 |
| 6. | Leaves 7-30 cm, fleshy, obovate, entire, glabrous; Flowers Feb-March; Fruits Feb-March, globose, 6 mm diam. **Euphorbia nivulia** Ham. | |
| | Leaves 6-13 mm, falling early, entire; Flowers Nov-Jan; Fruits Jan, globose, 13 mm diam. **Euphorbia antiquorum** Linn. | |
| 7. | Leaves crowded near ends of branches, 12-23 cm, elliptic-oblong, entire, coriaceous; Flowers March-April, cream-coloured; Fruits Sept-Nov, greenish, fleshy. **Madhuca indica** Gmel. *Bassia latifolia* (Roxb.) Macbr. | |
| | Leaves not crowded near ends of branches ... ... | 8 |
| 8. | Leaves glabrous above ... ... ... | 10 |
| | Leaves not glabrous ... ... ... | 9 |
| 9. | Epiphyte; leaves entire, 7-15 cm, elliptic-ovate / lanceolate / oblanceolate / rhomboid, 3-ribbed, hispid above, scabrous beneath, coriaceous; petiole 8-13 mm; Fruits May-July. **Ficus gibbosa** Bl. var. *parasitica* King. | |
| | Not epiphyte; leaves serrate, 25-100 mm, ovate / rhomboid / obovate, very scabrous; Flowers Feb-March, yellowish; Fruits April-May, pear-shaped, yellow. **Streblus asper** Lour. | |

10. Leaf tip long-acuminate, generally curved at end; leaves 10-18 cm, ovate-rotund, coriaceous; petiole 7-13 cm, slender; Flowers July-Sept; Fruits Sept-Nov. **Ficus religiosa** Linn.
Leaf tip not long acuminate ... ... ... 11

11. Leaves over 10 cm, entire ... ... ... 12
Leaves 5-10 cm, ovate-elliptic, abruptly acuminate, shining, coriaceous; peticle 13-25 mm; Flowers/Fruits Feb-May; receptacle blood red, 7 mm diam. **Ficus lacor** Buch-Ham.

12. Trees with aerial roots hanging from branches ... 13
Trees without aerial roots; leaves 10-23 cm, elliptic/obvate, shining; Flowers Feb-March; Fruits April-June. **Artocarpus heterophyllus** Lamk. *A. integrifolia* Linn. f.

13. Trees with many aerial roots; leaves 10-20 cm by 5-13 cm, elliptic/orbicular/ovate, glabrous/minutely pubescent beneath; petiole 2-5 cm; Flowers/Fruits at various times; receptacle red, globose, 15 mm diam, pubescent. **Ficus bengalensis** Linn.
Trees with few short aerial roots; leaves 10-18 cm by 35-65 mm, ovate-oblong/elliptic-lanceolate, 3-ribbed; petiole 8-45 mm; Flower/Fruits at various times, especially Sept-Nov; receptacles on short leafless warted branchlets from all over the branches and the trunk down to ground level. **Ficus glomerata** Roxb.

14. Trees armed ... ... ... ... 15
Trees unarmed ... ... ... 22

15. Leaves gland-dotted, aromatic, 25-80 mm, ovate-oblong/elliptic, entire, glabrous, coriaceous; Flowers Aug-Sept, white; Fruits Feb-April. **Atalantia monophylla** (Roxb.) DC.
Leaves not gland-dotted/aromatic ... ... 16

16. Leaves under 10 cm. ... ... ... 17
Leaves over 10 cm. ... ... ... 21

17. Thorns stipular; leaves not glabrous beneath ... 18
Thorns not stipular; leaves glabrous, 5-10 cm, ovate/obovate/sub-orbicular, crenate/serrate; Flowers Nov-March; Fruits March-May; leaf-fall Jan-Feb. **Flacourtia ramontchi** L'Herit.

18. Leaves palmately 3-nerved beneath ... ... 19
Leaves penni-nerved; thorns hooked; leaves 25-70 mm, elliptic-obovate, olive-green, velvety pubescent when young, older more or less pubescent; Flowers March-April; Fruits June-July, purple, globose, 25-40 mm. **Capparis grandis** Linn.

19. Thorns solitary, recurved ; leaves cordate at base, elliptic/elliptic-oblong, serrulate, tomentose beneath ; Flowers/Fruits April/June. **Zizyphus rugosa** Lam.

Thorns in pairs ; leaves not cordate at base ... ... 20

20. Leaves white/yellowish tomentose beneath, elliptic-oblong/sub-orbicular, crenate-serrate, obtuse ; Flowers April-June ; Fruits Sept-Feb, hard, globose, 15-25 mm diam. **Zizyphus xylopyrus** Willd.

Leaves densely woolly tomentose beneath, base more or less oblique, elliptic-ovate / orbicular, closely serrulate / entire, rounded at both ends, dark green, often shining above ; Flowers Sept-Nov, greenish yellow; Fruits Dec-Feb, orange/red, 13-19 mm diam. **Zizyphus mauritiana** Lamk. *Z jujuba* Lamk.

21. Spines present on young stems and base of old trees ; leaves 10-23 cm, elliptic-oblong, obtuse/retuse, coriaceous ; Flowers June-Sept ; Fruits Nov-Jan. **Bridelia retusa** Spreng.

Branchlets spinescent ; liveas 5-15 cm, oblong/ovate-lancolate, entire, glabrous above, pubescent on the nerves beneath ; Flowers March-April, white, fragrant ; Fruits May-June, purplish red. **Alangium salvifolium** (Linn. f.) Wang. *A. lamarckii*. Thw.

22. Leaves lobed ... ... ... ... 60

Leaves not lobed ... ... ... 23

23. Leaf margin entire ... ... ... 37

Leaf margin not entire ... ... ... 24

24. Leaves glabrous on both sides ... ... ... 33

Leaves not glabrous beneath ... ... ... 25

25. Leaves gland-dotted / lined, 7-18 cm, oblong/elliptic-oblong/lanceolate, densely pubescent beneath ; Flowers Dec-March/May-June; Fruits July-Aug. **Casearia tomentosa** Roxb.

Leaves not gland-dotted/lined ... ... ... 26

26. Glands 1-2 present on petiole or on either side of midrib at base of blade as dark spots ; leaves palmately 3-5 nerved ... 27

Glands not present as in above ... ... 29

27. Leaves white/ferruginous tomentose beneath ... ... 28

Leaves with many depressed red glands beneath, 8-20 cm by 35-130 mm, ovate-lanceolate, rounded at base; petiole tip curved and blade is set at an angle, 2-8 cm; branchlets tawny/rusty pubescent; Flowers Aug-Sept; Fruits Jan-March, covered with red powder. **Mallotus philippensis** Muel-Arg.

28. Leaves slightly peltate, stellately ferruginous tomentose beneath, 10-20 cm, orbicular/deltoid, entire/toothed; petiole 75-100 mm; Flowers/Fruits Aug-Nov
**Mallotus albus** Muel-Arg. var *occidentalis* Hook.

Leaves not peltate, white woolly beneath, 12-25 cm, broadly ovate/rotundate, acute, deeply cordate at base, dentate/incised; petiole upto 15 cm; branchlets clothed with white stellate tomentum; Flowers April-July; Fruits Dec-Feb.
**Givotia rottleriformis** Griff.

29. Leaves ovate/obliquely ovate/linear-oblong/oblong-lanceolate, 3-5 nerved at base ... ... ... 30

Leavs sub-orbicular/ovate-orbicular, 6-15 cm, obtuse/subacute, scabrous with white discs above, thinly fulvous-tomentose beneath; petiole up to 5 cm; bark smooth, grey green; Flowers May-Nov, white; Fruits Dec-Jan/April-May, yellow, ovoid, 16 mm. **Cordia wallichii** G. Don.

30. Leaves obliquely-ovate/oblong ... ... ... 31

Leaves linear to oblong-lanceolate, 5-23 cm by 8-65 mm, acute/acuminate, base cordate/rounded, serrulate, pubescent/scabrid above white/ashy tomentose baneath; petiole 8-50 mm.
**Debregaesia longifolia** (Burm.) Wedd. *D. velutina* Gaud.

31. Petiole under 3 cm long ... ... ... 32

Petiole 5-8 cm long; leaves obliquely ovate/oblong, 75-200 mm, acuminate, toothed, 2-3 lobed in young branches, scabrid above, pubescent beneath; Flowers April, White.
... **Broussonetia papyrifera** Vent.

32. Leaves serrate, 3–5 nerved at base, broadly/obliquely ovate, 75-130 mm, more or less lobed at tip, hoary tomentose beneath; Flowers Feb-April; Fruits May-June **Grewia tiliaefolia** Vahl.

Leaves crenate, 3-ribbed at base, obliquely ovate, 6-15 cm, acuminate, base unequal, rough above, softly often white pubescent beneath; Flowers Feb-March; Fruits April-May, black, globose.
**Trema orientalis** Bl.

33. Leaves lanceolate, 5-11 cm, sharply serrate-dentate; Flowers July-Sept; Fruits Oct-Dec. **Grewia glabra** Bl. *G. disperma* Rottl.

Leaves not lanceolate ... ... ... 34

34. Leaves crowded towards tips of branches, turn red before fall, broadly obovate/oblong, 15-30 cm, crenate/serrate; Flowers Feb-April, greenish white, 6-10 cm diam; Fruits June-July, 5-8 cm diam, globose, crowned by calyx lobes and style.
**Careya arborea** Roxb.

Leaves not crowded towards tips of branches, oblong/elliptic-oblong; branchlets drooping ... ... ... 35

35. Glands (1-2) present on petiole/midrib beneath ... ... 36
Glands absent on petiole/midrib; leaves 6-10 cm, elliptic-oblong, acute/obtuse/shortly acuminate, serrulate, shining, coriaceous; bark dark grey; Flowers April-May; Fruits July-Aug, white tomentose **Putranjiva roxburghii** Wall.

36. Bark deeply fissured, resembling crocodile skin; leaves 7-20 cm, ovate-oblong/elliptic-oblong, nearly glabrous, crenulate; glands 1-2, stalked some way up the midrib beneath from base; Flowers May-June; Fruits Nov-Jan.
**Terminalia crenulata** Heyne. *T. tomentosa* var *crenulata* C. B. Clarke.

Bark not resembling crocodile skin, light grey, smooth; leaves 10-15 cm, oblong/elliptic-oblong, often sub-opposite, crenulate; Flowers April-May; Fruits Nov-Jan; New leaves Feb-March.
**Terminalia arjuna** W. & A.

37. Leaves under 15 mm, subsessile, distichous, close-set on branchlets resembling compound leaves, narrowly linear-oblong, obtuse; Flowers Jan-March; Fruits till Nov-Dec, globose, 1-3 cm diam.
**Emblica officinalis** Gaertn.

Leaves over 25 mm ... ... 38

38. Stipules present, intra-petiolar/semi-amplexicaul; leaves 25-60 mm, obovate/cuneate-obovate, shining; Flowers Aug-Nov; Fruits Sept-Jan, red, ellipsoid. **Erythroxylon monogynum** Roxb.

Stipules absent, if present not as in above; leaves over 60 mm ... 39

39. Trees with acrid juice ... ... 40
Trees without acrid juice ... ... 43

40. Leaves lanceolate/oblong-lanceolate, 12-30 cm, coriaceous, acute, glabrous; Flowers Jan-March; Fruits April-June.
**Mangifera indica** Linn.

Leaves not lanceolate/ oblong-lanceolate ... ... 41

41. Leaves glabrous, 12-25 cm, obovate/elliptic, obtuse, coriaceous, Flowers Dec-Jan; Fruits Feb-June.
**Anacardium occidentale** Linn.

Leaves not glabrous beneath ... ... ... 42

42. Leaves villous beneath, broadly oblong, 12-25 cm, obtuse/emarginate; Flowers Jan-May; Fruits April-May.
**Buchanania lanzan** Spreng. *B. latifolia* Roxb.

Leaves pubescent/tomentose beneath, obovate-oblong, 15-50 cm, obtuse coriaceous; Flowers June-July; Fruits Nov, purplish black; leafless Feb-April. **Semicarpus anacardium** Linn.

43. Leaves with 1-2 glands on midrib beneath/on petiole ... 44
Leaves without glands on midrib/petiole ... ... 45

44. Leaves crowded towards tips of branches, 10-20 cm, broadly ovate-elliptic, often unequal, glabrous; petiole 35-80 mm; bark bluish/ashy grey/black at least at top with many fine longitudinal cracks; Flowers Feb-April; Fruits Nov; leafless Feb-March.
**Terminalia bellerica** Roxb.

Leaves not crowded towards tips of branches, lower often sub-opposite. 10-20 cm, oblong; petiole short; bark, dark brown rough, with many shallow fissures, pealing off in flat flakes; Flowers July-Dec; Fruits Nov-Feb, red, tomentose.
**Terminalia paniculata** Roth.

45. Leaves glabrous beneath ... ... ... 53
Leaves not glabrous beneath ... ... ... 46

46. Leaves penni-nerved ... ... ... 47
Leave digitately 3-5 nerved at base, stellately white/fulvous tomentose beneath, upto 13 cm, variable/orbicular-ovate; petiole about 4 cm; Flowers March-April, white; Fruits May-July. **Cordia dichotoma** Forst. *C. myxa* Roxb.

47. Leaves oblong-lanceolate/ovate/ovate-oblong ... ... 51
Leaves elliptic/elliptic-oblong/elliptic-lanceolate/obovate ... 48

48. Leaves crowded towards tips of branches, sparsely short hairy on veins, 10–18 cm by 6–9 cm, elliptic-obovate/obovate/ovate, abruptly acuminate, base acute, membranous; petiole 3–5 cm; Flowers July-Aug; Fruits Nov-Dec. **Mappia ovata** Miers.
Leaves not crowded towards tips of branches, pubescent/tomentose beneath ... ... ... ... 49

49. Bark and leaves with an offensive smell when crushed; leaves 7–13 cm by 25–80 mm, elliptic/broadly oblong, acuminate, on young shoots sometimes serrate; Flowers Jan-March; Fruits May-June, nearly orbicular, winged all round.
**Holoptelia integrifolia** Planch.

Bark and leaves without offensive smell ... ... 50

50. Leaves elliptic/elliptic-oblong, 6-15 cm, often sub-opposite, obtuse/subacute, pubescent beneath; Flowers Dec-Jan; Fruits Feb-March, yellow. **Diospyros melanoxylon** Roxb.
Leaves elliptic-lanceolate/obovate, 10–25 cm by 5-10 cm, shortly acuminate, finely yellowish white tomentose beneath; branchlets densely soft tomentose; Flowers Jan-March; Fruits Sept-Dec, black. **Litsea deccanensis** Gamble. *L. tomentosa* Heyne.

51. Leaves oblong-lanceolate, 7-20 cm by 25-50 mm, pubescent beneath; Flowers March-May; Fruits July-Aug. **Polyalthia cerasoides** (Roxb.) Bedd.

Leaves ovate/ovate-oblong ... ... ... 52

52. Petiole under 10 mm; leaves ovate-oblong, 10-30 cm by 6-10 cm, tomentose beneath, bark deeply cracked; Flowers March-April; Fruits June-July. **Miliusa tomentosa** (Roxb.) J. Sinclair. *Saccopetalum tomentosum* Hk. f, Th.

Petiole 25-50 mm; leaves ovate, 6-20 cm, thinly pubescent, coriaceous, bark greenish grey; Flowers Jan-March/July with a strong smell; Fruits Sept-Oct, red. **Nothapodytes foetida** (Wt.) Sleumer. *Mappia foetida* Miers.

53. Bark smooth/mottled with white patches ... ... 54

Bark not as in above ... ... ... 57

54. Bark and leaves with an offensive smell when crushed; leaves 7-13 cm by 25-80 mm, elliptic/ broadly oblong, acuminate, on young shoots sometimes serrate; Flowers Jan-March, Fruits May-June, nearly orbicular, winged all round. **Holoptelia integrifolia** Planch.

Bark and leaves without offensive smell when crushed ... 55

55. Bark mottled with white patches, exfoliating in thin rounded scales leaving shallow depressions; leaves obtuse/shortly cuspidate, 4-8 cm by 25-50 mm, elliptic/oblong-elliptic/sub-orbicular; gland dots visible from above; Flowers Oct-Jan; Fruits Jan-Feb/ July-Aug. **Anogeissus latifolia** Wall.

Bark not mottled with white patches ... ... 56

56. Leaves upto 10 cm by 5 cm, elliptic/obovate, acute, turn deep red before fall; nerves rusty pubescent beneath; Flowers May-June; Fruits Dec-Jan. **Antidesma diandrum** Roth

Leaves 35-140 mm, ovate-oblong/elliptic, dark green, densely velvety tomentose when young, glabrous and coriaceous when mature, sub-acute/acuminate, base rounded; sometimes, armed; Flowers April-May; Fruits Dec-Jan, globose, 25-38 mm diam. **Diospyros montana** Roxb.

57. Leaf tip rounded/retuse; leaves orbicular/broadly obovate/ elliptic, 35-100 mm, coriaceous; Flowers March-April; Fruits July-Aug, ellipsoid 15-25 mm diam, white tomentose. **Cleistanthus collinus** Benth.

Leaf tip not rounded/retuse ... ... ... 58

58. Leaves aromatic, gland-dotted, crowded at ends of branches 10-20 cm by 35-75 mm, oblong/spathulate (variable), dark green obove, glaucous beneath, pale green and reddish when young; petiole 25-38 mm; Flowers Dec-Jan, yellowish; Fruits April-May, black/dark green with white specks, aromatic, on persistent reflexed perianth. **Machilus macrantha** Nees

Leaves not aromatic/gland-dotted ... ... 59

59. Leaves 70-150 mm, acuminate/sub-acute, obovate/elliptic-oblong, tapering to base; Flowers May; Fruits Sept, black. **Ehretia leavis** Roxb.

Leaves 125-410 mm by 85-180 mm, acute, oblong, much narrowed to base; petiole 13-19 mm, midrib and veins raised on upper side; Flowers Dec-March, yellowish white, small; Fruits May-June, purplish black. **Meliosma simplicifolia** Walp.

60. Leaves 2-10 lobed ... ... ... 61

Leaves irregularly lobed especially those on coppices and young shoots, crowed at ends of branchlets, acute, nearly as long as broad, entire, glabrous, 3-nerved at base; petiole 25-125 mm; smooth, silvery grey; Flowers Jan-Feb; Fruits March-April when leafless, globose-ovoid, 13-19 mm diam, with 2 striate oblanceolate/spathulate 50-75 mm long wings. **Gyrocarpus jacquini** Green.

61. Leaves 2-lobed ... ... ... ... 62

Leaves 3-10 lobed (digitately) ... ... 63

62. Leaves acidic, 50-130 mm by 70-130 mm, broader than long, cleft to a third of length, 7-9 nerved, slightly cordate, glaucous beneath; Flowers Sept-Oct; Fruits March-April. 30-45 cm by 19-25 mm, 20-30 seeded. **Piliostigma malabaricum** (Roxb.) Benth.
*Bauhinia malabarica* Roxb.

Leaves not acidic; 19-50 mm, broader than long, cleft nearly half way down, entire, glabrous above, white and minutely pubescent beneath; Flowers March-April; Fruits Nov-Jan, 15-30 cm, falcate, 10-20 seeded. **Bauhinia racemosa** Linn.

63. Leaves 3-7 lobed; lobes entire, glabrous above, white tomentose beneath ... ... ... ... 64

Leaves 7-10 lobed, serrate; bark thin, greyish brown; Flowers/fruits at various times; cultivated. **Ricinus communis** Linn.

64. Leaves 7-20 cm; lobes acute; petiole 10-20 cm; Flowers Feb-April, 10-13 cm diam, golden yellow; Fruits April-June; seeds with a mass of white silky wool. **Cochlospermum religiosum** (Linn.) Alston.
*C. gossypium* DC.

Leaves 20-30 cm; lobes shallow, acute; petiole 12-25 cm, velvety; bark, smooth, white; papery, Flowers Dec-Jan when leafless, yellow; Fruits April-July, of 4-6 ovoid follicles, woody, covered with dense pubescene mixed with shining hairs. **Sterculia urens** Roxb.

65. Trees with milky juice ... ... ... 66

Trees without milky juice ... ... ... 69

66. Leaves in whorls of 5-10 **Alstonia scholaris** R. Br.

Leaves opposite... ... ... ... 67

67. Stipules present, often sheathing (budscale), deciduous leaving an annular scar; leaves hispid/scabrid above, 10-35 cm, elliptic-ovate/oblong; Flowers/Fruits all through the year especially Jan-Feb; receptacles axillary on short branchlets from old wood, yellowish. **Ficus hispida** Linn.

Stipules absent ... ... ... ... 68

68. Leaves 10-30 cm by 35-130 mm, ovate-oblong, rounded at base, subsessile; nerves prominent; Flowers June-July; Fruits Feb-March, of 2 narrow follicles free at tip later. **Holarrhena antidysenterica** Wall.

Leaves 7-18 cm, elliptic-lanceolate/oblong-lanceolate, acuminate, entire, whitish beneath; Flowers March-July, white, scented, 19 mm across; Fruits Aug-Sept, of 2 narrow cylindrical follicles, jointed at tip. **Wrightia tinctoria** R. Br.

69. Stipules present... ... ... ... 70

Stipules absent ... ... ... ... 78

70. Stipules inter-petiolar (in-between to opposite petioles) ... 72

Stipules intra-petiolar (within the petiole/between the petiole and the stem), connate ... ... ... 71

71. Trees armed; leaves crowded at ends of branches, 25-100 mm, elliptic/obovate/orbicular, coriaceous, obtuse, entire; Flowers March-April, white, fragrant; Fruits July-Sept, 25-75 mm diam. **Gardenia turgida** Roxb.

Trees unarmed; leaves sometimes in whorls of 3, 10-30 cm, broadly elliptic/obovate, tip rounded; Flowers April-May, white, fragrant, 5-8 cm diam; Fruits June-July, globose, 3-6 cm diam. **Gardenia latifolia** Ait.

72. Leaves glabrous... ... ... ... 74

Leaves pubescent/tomentose beneath ... ... 73

73. Leaves orbicular-cordate, 10-25 cm diam, shortly acuminate, entire; petiole 5-10 cm; bark grey, exfoliating in patches; stipules obovate/oblong, connate, 13-19 mm, obtuse, pubescent; Flowers May-Aug, yellow, in globose heads; Fruits Oct-Nov; leafless Feb-May. ... **Adina cordifolia** Hook. f.

Leaves elliptic-lanceolate, 75-250 mm by 25-65 mm, dull green; bark corky, brittle, pale brown, deeply cracked; Flowers/Fruits Sept-Oct; fruit a syncarpium, under 19 mm diam. **Morinda tinctoria** Roxb.

74. Leaves ovate/ovate-lanceolate, 5-15 cm, coriaceous, obtusely caudate-acuminate, entire, shining above; Flowers Dec-Feb/April-Aug, white, fragrant; Fruits April-May/July-Oct, globose, black/dark purple. **Canthium dicoccum** (Gaertn.) Merr. *C. didymum* Roxb.

Leaves not ovate/ovate-lanceolate ... ... 75

75. Petiole 9-20 mm long ... ... ... 76

Petiole under 9 mm; leaves 75-130 mm, obovate/oblong/elliptic, obtuse; entire, shining; stipules broadly ovate with a cuspidate point; Flowers Jan-March, white, fragrant; Fruits April-May. **Ixora arborea** Roxb ex Seem. *I. parviflora* Vahl.

76. Leaves elliptic/elliptic-lanceolate, acute/acuminate; petiole 13 mm long ... ... 77

Leaves obovate/suborbicular, 5-18 cm; usually obtuse, entire; petiole 9-20 mm; stipules caducous, oblong-spathulate, crimson when young; Flowers June-July, in dense globose heads; Fruits Sept; leafless April-May. **Mitragyne parvifolia** (Roxb.) Korth. *Stephegyne parvifolia* Korth.

77. Leaves elliptic/elliptic-lanceolate, 10-20 cm, acute/acuminate, entire; peduncle 25-65 mm; Flowers Feb-March, purple, globose, in dense heads; Fruits June-Aug. **Neonauclea purpurea** Merr. *Nauclea purpurea* Roxb.

Leaves broadly elliptic, 12-23 cm by 75-130 mm, acute, shining; stipules connate, broad, obtuse; Flowers May-Sept, white, in dense ovoid heads; Fruits Oct, a syncarpium formed by enlarged fleshy calyces, about 25 mm diam. **Morinda citrifolia** Linn.

78. Leaves glabrous beneath ... ... ... 79

Leaves hairy/scabrous/tomentose beneath ... ... 86

79. Leaves 3-5 nerved at base ... ... ... 80

Leaves penni-nerved ... ... ... ... 82

80. Petiole under 2 cm long ... ... ... 81

Petiole 5-10 cm long; leaves 7-10 cm, ovate, base cordiate/ rounded, acuminate; Flowers Feb-March; Fruits June-July **Trewia nudiflora** Linn.

81. Leaves 75-150 mm, broadly elliptic/ovate-elliptic, acute/shortly acuminate/obtuse, entire; 5-nerved at base, 3 central ones prominent, shining, sometimes armed with sharp axillary spines; Flowers Feb-April with a strong unpleasant smell; Fruits Nov-March; orange-red, globose, 25-50 mm diam. **Strychnos nux-vomica** Linn.

Leaves 50-100 mm, nearly sessile, ovate/elliptic, subcoriaceous, acute/subacuminate, falsely 3-5 nerved at base, entire, shining; bark black, cracked, scaly; Flowers Feb-April, white; Fruits Nov-March, black, 19 mm diam. **Strychnos potatorum** Linn.

82. Leaves gland-dotted with submarginal veins, 7-15 cm, elliptic-lanceolate, acute/shortly acuminate, entire, shining; secondary nerves very close, parallel; Flowers Feb-May, white, fragrant; Fruits June-Aug, dark purple, edible. **Syzygium cumini** (Linn.) Skeels.

Leaves not gland-dotted ... ... ... 83

83. Bark ashy/pinkish/yellowish white, peeling off in long strips, smooth; branchlets quadrangular, 4-winged; leaves 5-10 cm, elliptic-/ovate/lanceolate, acute, entire, somewhat downy/bluish white beneath; nerves prominent beneath; Flowers March-May/ May-July, white/pinkish; Fruits June-July/Aug-Nov. **Lagerstroemia lanceolata** Wall.

Bark not as in above; leaves 35-180 mm. . ... 84

84. Leaves 35-80 mm, elliptic-lanceolate/-ovate, entire; bark rough with short vertical cracks, dark grey to black, dark red within; Flowers May-June, pale yellow to purple; Fruits Oct-Dec, black purple, globose, 13 mm diam. **Santalum album** Linn.

Leaves 70-180 mm. ... ... ... 85

85. Leaves broadly lanceolate/elliptic-oblanceolate, 70-180 mm, cuneate at base, obtuse to shortly acuminate, entire; Flowers Jan-Feb, white; Fruits Feb-May. **Linociera malabarica** Wall.

Leaves elliptic-/ovate/-lanceolate, 70-180 mm, acuminate, acute at base, distantly toothed/entire; Flowers Jan-March, creamy white; Fruits April-June. **Olea dioica** Roxb.

86. Leaves under 30 cm. ... ... ... 87

Leaves 30-60 cm, ovate/elliptic/obovate ,acute/acuminate, entire, rough above, densely grey tawny tomentose beneath, thickly coriaceous; branchlets quadrangular; Flowers June-Aug, white; Fruits Nov-Jan, felted, enclosed in enlarged calyx. **Tectona grandis** Linn.

87. Leaves with 2 glands at base on upper side near midrib, 7-25 cm, broadly ovate, acuminate, fulvous tomentose beneath; branchlets covered with fine white mealy pubescence; Flowers March-May, appearing with/before new leaves, brownish yellow; Fruits Nov-Dec, orange yellow, leafless Jan-Feb. **Gmelina arborea** Linn.

Leaves without glands as in above ... ... 88

88. Leaves entire, minutely glandular scabrous above, yellowish stellate-woolly beneath; 10-20 cm, broadly ovate, acuminate, coriaceous; branchlets densely stellate woolly; Flowers March-April, Fruits June. **Premna tomentosa** Linn.

Leaves dentate, glandular and shining above, densely stellate tomentose beneath, 15-25 cm, ovate/ovate-lanceolate, acuminate; young branchlets densely soft tomentose; Flowers March-April, sessile, purple; Fruits July-Aug, black. **Callicarpa tomentosa** (Linn.) Murray. *C. lanata* Linn.

89. Leaves allernate ... ... ... 90

Leaves opposite ... ... ... 133

90. Leaflets 3 ... ... ... ... 91

Leaflets more than 3 ... ... ... 95

91. Trees armed ... ... ... ... 92

Trees unarmed ... ... ... ... 93

92. Thorns axillary; leaflets aromatic; gland-dotted, 25-60 mm, obovate, entire, glabrous, shining; petiole winged, 25-38 mm; Flowers March-April; Fruits July-Sept. **Limonia alata** W. & A.

Prickles not axillary (on branches); leaflets not aromatic/gland-dotted, 5-13 cm, as broad as long, terminal reniform-cordate, lateral unequal sided, ovate, acuminate, entire, glabrous; petiole upto 15 cm; Flowers March-April, bright scarlet; Fruits July-Aug, torulose. **Erythrina stricta** Roxb.

93. Stipules present; leaflets pinnate... ... ... 94

Stipules absent; leaflets digitate, 5-15 cm, ovate-lanceolate/obovate, acute/acuminate, entire, glabrous; rachis 10 cm; Flowers Dec/Feb-March, 38-50/ mm diam, yellowish white Fruits July-Aug/Sept. **Crataeva nurvala** Buch-Ham. *C. religiosa* Forst.

94. Leaflets entire, 10-23 cm, terminal obovate, lateral oblique ; rachis 12-20 cm; Flowers Feb-March, bright orange red ; Fruits June-July. 1-seeded, **Butea monosperma** (Lamk.) Taub. *B. frondosa* Koen.

Leaflets obscurely crenate, 75-150 mm, terminal broadly elliptic/roundish, lateral obliquely ovate, obtuse; Flowers Feb-April when leafless, white/pinkish; Fruits May-June, 2-5 jointed. **Ougeinia oojeinensis** (Roxb.) Hochreut. *O. dalbergioides* Benth.

95. Leaflets digitate ... ... ... 96

Leaflets pinnate/bipinnate/tripinnate ... ... 97

96. Bark armed with conical prickles; leaflets 5-7, 75-200 mm, lanceolate/ovate, cuspidate, entire, glabrous; rachis upto 20 cm; Flowers Dec-Jan/March, scarlet ; Fruits April/May-June; seeds covered with white silky hairs. **Bombax ceiba** Linn. *B. malabaricum* DC.

Bark unarmed; leaflets 5-9, 100-180 mm, oblong-lanceolate, entire, glabrous; rachis 15-23 cm; wood with a foetid smell; Flowers Feb-April, dull orange red having pungent smell; Fruits Aug-Nov, scarlet, of 1-5 follicles. **Sterculia foetida** Linn.

97. Leaves pinnate ... ... ... ... 98

Leaves bipinnate/tripinnate .. ... ... 118

98. Leaflets even (paripinnate) ... ... ... 99

Leaflets odd (imparipinnate) ... ... ... 107

99. Leaflets over 8 pairs ... ... ... 103

Leaflets 2-8 pairs ... ... ... 100

100. Leaflets 2-3 pairs ... ... ... 101

Leaflets 3-8 pairs ... ... ... 102

101. Leaflets slightly acute/acuminate, slightly pubescent beneath, subopposite, 75-180 mm, lanceolate/elliptic-lanceolate; Flowers Oct-Dec, dirty white; Fruits March. **Sapindus trifoliatus** Hiern. *S. laurifolius* Vahl.

Leaflets obtuse, glabrous, 5-23 cm, lyrate, oblong, entire; Flowers Feb-March, white/yellowish; Fruits May. **Schleichera oleosa** (Lour) Oken. *S. trijuga* Willd.

102. Leaflets 3-6 pairs, 5-12 cm, elliptic/oblong, obtuse, glabrous; rachis often red; Flowers March/April-May, white; Fruits June/July-Aug; seeds winged. **Soymida febrifuga** A. Juss.

Leaflets 4-8 pairs 5-15 cm, ovate/ovate-oblong, acute, entire, glabrous; Flowers March-April, bright yellow, appearing with new leaves; Fruits July-Feb, 30-90 cm, black. **Cassia fistula** Linn.

103. Leaflets 3-23 cm long, 8-15 pairs ... ... 104

Leaflets under 3 cm long, 10-20 pairs ... ... 106

104. Leaflets entire, 9-15 pairs ... ... ... 105

Leaflets coarsely irregularly) toothed/ sublobate, 8-14 pairs, subopposite, 10-15 cm. variable in shape, glabrous; petiole 19-50 mm; rachis 30-90 cm, glandular hairy; Flowers March; Fruits June, winged. **Ailanthus excelsa** Roxb.

105. Stipules present; leaflets under 5 cm, oblong, emarginate; Flowers Feb-March, appearing with new leaves, pinkish, 19 mm across; Fruits April-May, 20-30 cm. **Cassia marginata** Roxb.

Stipules absent; leaflets 5-23 cm by 25-100 mm, lanceolate/oblique, acuminate, glossy above, pale beneath; leaves and bark bitter; Flowers Jan-April/Nov-Jan, appearing with young leaves; Fruits May-Oct (dates vary). **Toona ciliata** Roem. *Cedrela toona* Roxb.

106. Leaflets gland-dotted, subsessible, 25 mm, oblique, dull bluish-green; bark light grey, corky; Flowers Feb-April, white; Fruits May-June, seeds winged. **Chloroxylon swietenia** DC.

Leaflets not gland-dotted, sessile, 10-20 mm, oblong, obtuse, entire, glabrous; Flowers April-May, yellow with pink streaks; Fruits Feb-March; seeds not winged. **Tamarindus indica** Linn.

107. Trees armed; leaflets aromatic, gland-dotted ... ... 108

Trees unarmed ... ... ... ... ... 109

108. Rachis and petiole jointed, winged; leaflets 5-9, 25-50 mm, trapezoid-ovate/ovate-lanceolate, crenate, glabrous, tip notched; Flowers April-May; Fruits July-Aug. **Limonia acidissima** Linn.

Rachis and petiole flat, sometimes narrowly winged; leaflets 3-7, opposite, 25-50 mm, cuneate/obovate, glabrous; Flowers Feb-March; Fruits July-Oct.
**Feronia limonia** (Linn.) Swingle. *F. elephantum* Cor.

109. Leaflets entire ... ... ... ... 111

Leaflets serrate/crenate ... ... ... 110

110. Leaflets 13-21, crowded at tips. turn bright red before fall, 6-15 cm, lanceolate/ovate-lanceolate, crenate, acuminate, glabrous; Flowers April-May; Fruits Oct-Nov; leafless Dec-April **Garuga pinnata** Roxb.

Leaflets 9-15, 3-10 cm, obliquely lanceolate/falcate, serrate, acuminate, glabrous; rachis 20-40 cm; Flowers March-May, white; Fruits July-Aug, yellow. **Azadirachta indica** A. Juss.

111. Leaflets under 65 mm ... ... ... 112

Leaflets over 65 mm ... ... ... 115

112. Leaflets 3-11, over 25 mm ... ... ... 113

Leaflets 9-13, 19-25 mm, oblong/obovate/elliptic, obtuse/retuse, glabrous, base rounded; turn black on drying; Flowers March, bluish white in dense panicles; Pods Oct-Jan, 25-50 mm, 1-2 seeded. **Dalbergia Paniculata** Roxb.

113. Leaflets 3-5, acuminate-cuspidate, 38-65 mm by 30-50 mm, broad ovate/rhomboid; rachis 5-10 cm; zigzag; Flowers March-April/June; Fruits Nov-Jan/July. **Dalbergia sissoo** Roxb.

Leaflets 5-11, not acuminate-cuspidate ... ... 114

114. Leaflets 5-7, obtuse/emarginate, 25-65 mm, broadly ovate/orbicular, glabrous; Flowers Jan-March, whitish; Pods Nov-Jan, 50-75 mm, oblong-lanceolate, obtuse at tip. **Dalbergia latifolia** Roxb.

Leaflets 7-11, acute, 30-50 mm, obovate/ovate, glabrous, young ones yellowish; Flowers July-Aug; Pods Oct-Jan, acute at tip. **Dalbergia sissoides** Grah.

115. Stipules present; leaflets 5-7, glabrous ... ... 116

Stipules absent; leaflets 3-11, glabrous ... ... 117

116. Rachis under 14 cm; leaflets acute/acuminate, 5-13 cm, ovate/oblong/rotund; bark grey speckled with brown; Flowers March-May, pinkish white; Pods June-July, flat, 35-50 mm; falcate, woody, 1-seeded. **Pongamia pinnata** (Linn.) Pierre.

Rachis 17-23 cm; leaflets obtuse/retuse, 7-13 cm, elliptic; bark dark brown/grey, deeply cracked, exuding red juice when cut; Flowers June-Aug, yellow; Fruits Jan-April, orbicular, 25-50 mm diam, winged all round. **Pterocarpus marsupium** Roxb.

117. Leaflets 3-7, long-acuminate, 35-80 mm, ovate, shining, unequal at base; bark green, turning brown; Flowers March/July; Fruits June-Aug.
**Commiphora caudata** (W. & A.) Engler. *Protium caudatum* W. & A.

Leaflets 7-11, acuminate, 75-150 mm, pinking when young, oblong/ovate-oblong, base oblique; bark grey, smooth; Flowers Jan-April when leafless; Fruits May-June, red.
**Lannea coromandelica** (Houtt.) Merril. *L. grandis* (Dennst.) Engler.

118. Trees armed ... ... ... 119
Trees unarmed ... ... ... 123

119. Bark dark brown, rough ... ... ... 120
Bark not dark brown ... ... ... 122

120. Pinnae under 5 cm long ... ... ... 121

Pinnae 5-8 cm long, 3-6 pairs with 1 gland between the uppermost pair of pinnae and a large gland on rachis; leaflets 15-30 pairs. 5-8 mm, linear-oblong, obtuse, glabrous; Flowers May-June/Aug-Sept; spikes pale yellow; Pods March/Dec-Feb, flat, 75-180 mm. **Acacia ferruginea** DC.

121. Pinnae 4-6 pairs, 19-50 mm; rachis often glandular; leaflets 10-25 pairs, 3-6 mm, linear-oblong, sub-obtuse, entire, glabrous; Flowers June-Aug/Nov-Dec, yellow; spikes globose (heads); Pods Dec-April, constricted, 75-150 mm, compressed, grey downy. **Acacia arabica** Willd.

Pinnae 10-30 pairs, 38-50 mm; rachis with a large gland at/near middle; glands present between insertion of several of the pinnae; leaflets 30-50 pairs, pubescent, 3-6 mm, linear, sub-acute; Flowers May-Oct, yellow; spikes 5-10 cm long; Pods Jan-March, 5-8 cm long. **Acacia catechu** Willd. var. *sundra* Prain.

122. Bark thin, membranous, peeling off in small papery flakes, marked at intervals by horizontal patches of darker colour; pinnae 10-30 pairs, 38-60 mm; leaflets 30-50 pairs, 6 mm, linear,

subacute, entire, rachis 10-25 cm with a large cup-shaped gland above base; Flowers March-May, white; spikes 75-100 mm; Pods March-May, flat, beaked, 75-130 mm.
**Acacia suma** Buch-Ham.

Bark thick, not membranous, exfoliating in irregular flakes; pinnae 5-15 pairs, 2-4 cm, with a cup-shaped gland between each pair of pinnae; leaflets 15-25 pairs, 3-6 mm, linear-oblong, entire, glabrous; Flowers June-July/Aug-Dec, dirty white in globose spikes (heads); Pods Dec-May, 7-20 cm, strap-shaped, velvety. **Acacia leucophloea** Willd.

123. Trunk branched, not straight ... ... ... 124

Trunk unbranched, straight; a tall palm; stem grey, annulate, over 12 metres high, about 46 cm diam; leaves 540-910 cm by 300-370 cm, arching and dropping; leaflets 10-20 cm, tip praemorse; petiole stout, sheathing; sheath smooth; Flowers/Fruits at all times. **Caryota urens** Linn.

124. Leaflets entire ... ... ... ... 126

Leaflets toothed/serrate ... ... ... 125

125. Stipules present, large; petiole dilated at base; leaflets about 15 cm by 10 cm, lanceolate, coarsely serrate, acuminate; Flowers/Fruits all the year round. **Leea indica** (Burm.) Merr. *L. sambucina* Willd.

Stipules absent; leaflets 5-11 on each pinna, 19-75 mm, ovate-lanceolote/oblique, terminal largest; leaves 2-3 pinnate, 20-75 cm; Flowers Jan-March, white, appearing with leaves; Fruits Oct-Jan, yellowish, ovoid, 25-40 mm. **Melia composita** Willd.

126. Pinnae 1 pair with a large gland in between; leaflets 2-6 pairs on each pinna with a small gland in-between; Flowers March-April when leafless; Pods Dec, flat, woody, falcate-oblong, 10-15 cm by 50-65 mm. **Xylia xylocarpa** Roxb.

Pinnae more than 1 pair ... ... ... 127

127. Pinna 25-70 mm long, leaflets under 10 mm ... ... 128

Pinna 75-400 mm long. leaflets over 20 mm ... ... 130

128. Pinna 25-50 mm long ... ... ... 129

Pinna 50-70 mm, 7-20 pairs; rachis pulvinate with a sessile gland below middle and glands at base of all but the lowest 1-4 pairs of pinnae; stipules large with a long tail, brown; deciduous; leaflets 30-50 pairs, 6-9 mm, linear-oblong, falcate, pubescent beneath; Flowers April-June; Pods Nov-Dec, 10-20 cm.
**Albizzia chinensis** (Osbeck.) Merr. *A. stipulata* Boiv.

129. Pinnae 12-30 (even); leaves 5-10 cm, with a small gland at middle of rachis and a gland between the uppermost pair of pinnae; leaflets 15-30 pairs, closely packed, 6-7 mm, linear-oblong, obtuse/subacute, pubescent beneath; Flowers April-Aug, yellow, fragrant; Pods Nov-Jan, 10-13 cm, very thin. **Albizzia amara** Boiv.

Pinnae 11-13 (odd), end one largest; leaves 75-130 mm without glands on rachis; leaflets 15-24 pairs, 3-6 mm, oblong, rounded at both ends, glabrous; Flowers June-Aug, pale yellow; Pods Oct-Dec, twisted. **Caesalpinia coriaria** Willd.

130. Pinnae 3-20 pairs (even); rachis glandular near base ... 131

Pinnae 5-13 (odd), upto 40 cm, pulvinate; rachis without glands upto 90 cm, pulvinate; leaflets bright red when young, 5-7 pairs on each pinna, opposite, 75-200 mm, elliptic-lanceolate/ovate-lanceolate, wavy; Flowers Dec-Feb; Fruits May-June. **Acrocarpus fraxinifolius** Wt.

131. Leaflets 5-10 pairs on each pinna ... ... 132

Leaflets 10-20 pairs on each pinna, 2-3 cm, oblong/falcate, pubescent; pinnae 3-8 pairs, 75-100 mm, glands present at base of 1 or 2 of the upermost pinnae; Flowers March-June, white, fragrant; Pods Sept-Dec, hanging long on the tree, 10-20 cm, reddish brown with dark markings over seeds, flexible. **Albizzia odoratissima** Benth.

132. Pinnae 2-3 pairs, 12-15 cm; one rachis 17-23 cm; or more small glands present between upper pinnae; bark brownish grey, rough; leaflets 5-9 pairs, 25-45 mm, obliquely oblong, glandular between their bases; Flowers Feb-April, greenish, fragrant; Pods Sept-Oct, when leafless and remains long on the tree rattling with wind, straw coloured, thin, 20-30 cm. **Albizzia lebbek** Benth.

Pinnae 3-6 pairs, 12-25 cm; rachis about 30 cm; glands absent between pinnae; bark yellowish white, smooth; leaflets 5-10 pairs, often with a small gland between uppermost pair, 25-50 mm, obliquely oblong-ovate, pubescent beneath; Flowers June-Aug, yellowish-white; Pods Oct-May, red/dark reddish brown. 10-20 cm, thin. **Albizzia procera** Benth.

133. Leaflets digitate, 3-5; rachis winged; Flowers April-Aug; white, tinged with blue; Fruits June-Sept, purple, globose. **Vitex altissima** Linn.

Leaflets pinnate/bipinnate/tripinnate ... ... 134

134. Leaves pinnate ... ... ... ... 135

Leaves bipinnate/tripinnate ... ... ... 137

135. Leaflets 3-7 ... ... ... ... ... 136

Leaflets 7-11, purple when young, 10-15 cm, ovate-caudate, long-acuminate; Flowers April-June, yellow, veined with red; Fruits Nov-Dec, 4–angled, somewhat spirally twisted, smooth, curved.
**Stereospermum personatum** (Hassk.) Chatterjee. *S. tetragonum* DC. *S. chelonoides* C. B. Clarke.

136. Leaflets 40-100 mm, ovate/elliptic, acuminate; Flowers Jan-Feb, white, fragrant; Fruits Nov-Dec; speckled, upto 30 cm by 16 mm, arcuate.
**Dolichandrone atrovirens** (Heyne ex Roth.) Sprague. *D. crispa* Seem.

Leaflets 13-38 mm, orbicular/obovate; Flowers May-June, white; Fruits July-Sept, not speckled, 25-50 cm by 19 mm, flat.
**Dolichandrone falcata** Seem.

137. Leaflets 3-5 on each pinna (pinnule), 75-180 mm by 50-65 mm, ovate, acuminate; leaves triangular in outline; rachis stout, terete; Flowers April-June, purple; Fruits Oct-Jan, straight, flat, 40-80 cm by 6-9 cm, tapering at both ends. **Oroxylum indicum** Vent.

Leaflets 3-9 on each pinna (pinnule), 50-75 mm by 20-40 mm, lanceolate, acute; rachis angular; Flowers March-May, when leafless, white tinged with yellow, fragrant; Fruits Nov-Jan, slightly curved, cylindrical, 30-75 cm by 25-40 mm, woody with hard tubercles. ... **Radermachera xylocarpa** (Roxb.) K. Schum. *Stereospermum xylocarpum* Benth. & Hk. f.

## LIST OF TREES IN THE KEY

1. Acacia arabica Willd. ... Mimosae-Leguminosae
2. ,, catechu Willd. ... ,,
3. ,, ferruginea DC. ... ,,
4. ,, leucophloea Willd. ... ,,
5. ,, suma Buch-Ham. ... ,,
6. Acrocarpus fraxinifolius Wt. ... Caesalpinae-Leguminosae
7. Adina cordifolia Hook. f. ... Rubiaceae
8. Ailanthus excelsa Roxb ... Simaroubaceae
   *Alangium lamarckii* Thw. ... Alangiaceae
9. Alangium salvifolium (Linn. f.) Wang. ... ,,
10. Albizzia amara Boiv. ... Mimosae-Leguminosae
11. Albizzia chinensis (Osbeck.) Merr. ... ,,
12. ,, lebbek Benth. ... ,,
13. ,, odoratissima Benth. ... ,,
14. ,, procera Benth. ... ,,
    ,, *stipulata* Boiv. ... ,,
15. Alstonia scholaris R. Br. ... Apocynaceae
16. Anacardium occidentale Linn. ... Anacardiaceae

| | | |
|---|---|---|
| 17. | Anogeissus latifolia Wall. | ... Combretaceae |
| 18. | Antidesma diandrum Roth. | ... Euphorbiaceae |
| 19. | Artocarpus heterophyllus Lamk. | ... Moraceae |
| | ,, *integrifolia* Linn. f. | ... ,, |
| 20. | Atalantia monophylla (Roxb.) DC. | ... Rutaceae |
| 21. | Azadirachta indica A. Juss. | ... Meliaceae |
| | *Bassia latifolia* (Roxb.) Macbr. | ... Sapotaceae |
| | *Bauhinia malabarica* Roxb. | ... Caesalpinae-Leguminosae |
| 22. | Bauhinia racemosa Linn. | ... ,, |
| 23. | Bombax ceiba Linn. | ... Bombacaceae |
| | ,, *malabaricum* DC. | ... ,, |
| 24. | Bridelia retusa Spreng. | ... Euphorbiaceae |
| 25. | Broussonetia papyrifera Vent. | ... Moraceae |
| 26. | Buchanania lanzan Spreng. | ... Anacardiaceae |
| | ,, *latifolia* Roxb. | ... ,, |
| | *Butea frondosa* Koen. | ... Papilionae-Leguminosae |
| 27. | Butea monosperma (Lamk.) Taub. | ... ,, |
| 28. | Caesalpinia coriaria Willd. | ... Caesalpinae-Leguminosae |
| 29. | Callicarpa tomentosa (Linn.) Murry. | ... Verbenaceae |
| | ,, *lanata* Linn. | ... ,, |
| 30. | Canthium dicoccum (Gaertn.) Merr. | ... Rubiaceae |
| | ,, *didymum* Roxb. | ... ,, |
| 31. | Capparis grandis Linn. | ... Capparidaceae |
| 32. | Careya arborea Roxb. | ... Lecythidaceae |
| 33. | Caryota urens Linn. | ... Palmaceae |
| 34. | Casearia tomentosa Roxb. | ... Samydaceae |
| 35. | Cassia fistula Linn. | ... Caesalpinae-Leguminosae |
| 36. | ,, marginata Roxb. | ... ,, |
| | *Cedrela toona* Roxb. | ... Meliaceae |
| 37. | Chloroxylon swietenia DC. | ... ,, |
| 38. | Cleistanthus collinus Benth. | ... Euphorbiaceae |
| | *Cochlospermum gossypium* DC. | ... Bixaceae |
| 39. | Cochlospermum religiosum (Linn.) Alston. | ... ,, |
| 40. | Commiphora caudata (W. & A.) Engler. | ... Burseraceae |
| 41. | Cordia dichotoma Forst. | ... Boraginaceae |
| | ,, *myxa* Roxb. | ... ,, |
| 42. | ,, wallichii G. Don. | ... ,, |
| 43. | Crataeva nurvala Buch-Ham. | ... Capparidaceae |
| | ,, *religiosa* Forst. | ... ,, |
| 44. | Dalbergia latifolia Roxb. | ... Papilionae-Leguminosae |
| 45. | ,, paniculata Roxb. | ... ,, |
| 46. | ,, sissoides Grah. | ... ,, |
| 47. | ,, sissoo Roxb. | ... ,, |
| 48. | Debregaesia longifolia (Burm.) Wded. | ... Urticaceae |
| | ,, *velutina* Gaud. | ... ,, |
| 49. | Diospyros melanoxylon Roxb. | ... Ebenaceae |
| 50. | ,, montana Roxb. | ... ,, |

| | | |
|---|---|---|
| 51. | Dolichandrone atrovirens (Heyne ex Roth.) Sprague. ... | Bignoniceae |
| | ,, *crispa* Seem. ... | ,, |
| 52. | ,, falcata Seem. ... | ,, |
| 53. | Ehretia laevis Roxb. ... | Boraginaceae |
| 54. | Emblica officinalis Gaertn. ... | Euphorbiaceae |
| 55. | Erythrina stricta Roxb. ... | Papilionae-Leguminosae |
| 56. | Erythroxylon monogynum Roxb. ... | Linaceae |
| 57. | Euphorbia antiquorum Linn. ... | Euphorbiaceae |
| 58. | ,, nivulia Ham. ... | |
| 59. | ,, tortillis Rottl. ... | ,, |
| | *Feronia elephantum* Corr. ... | Rutaceae |
| 60. | Feronia limonia (Linn.) Swingle. ... | ,, |
| 61. | Ficus bengalensis Linn. ... | Moraceae |
| 62. | ,, gibbosa Bl. ... | ,, |
| 63. | ,, glomerata Roxb. ... | ,, |
| 64. | ,, hispida Linn. ... | ,, |
| 65. | ,, lacor Buch-Ham. ... | ,, |
| 66. | ,, religiosa Linn. ... | ,, |
| 67. | Flacourtia ramontchi L'Herit. ... | Bixaceae |
| 68. | Gardenia latifolia Ait. ... | Rubiaceae |
| 69. | ,, turgida Roxb. ... | ,, |
| 70. | Garuga pinnata Roxb. ... | Burseraceae |
| 71. | Givotia rottleriformis Griff. ... | Euphorbiaceae |
| 72. | Gmelina arborea Linn. ... | Verbenaceae |
| | *Grewia disperma* Rottle | Tiliaeceae |
| 73. | Grewia glabra Bl. ... | ,, |
| 74. | ,, tiliaefolia Vahl. ... | ,, |
| 75. | Gyrocarpus jacquini Gaertn. ... | Hernandiaceae |
| 76. | Holoptelia integrifolia Planch. ... | Ulmaceae |
| 77. | Holarrhena antidysenterica Wall. ... | Apocynaceae |
| 78. | Ixora arborea Roxb. ex Seem. ... | Rubiaceae |
| | ,, *parviflora* Vahl. ... | ,, |
| 79. | Lagerstroemia lanceolata Wall. ... | Lythraceae |
| | *Lannea grandis* (Dennst.) Engler. ... | Anacardiaceae |
| 80. | Lannea coromandelica (Houtt.) Merril. ... | ,, |
| 81. | Leea indica (Burm.) Merr. ... | Vitaceae |
| | ,, *sambucina* Willd. ... | ,, |
| 82. | Limonia acidissima Linn. ... | Rutaceae |
| 83. | ,, alata W. & A. ... | ,, |
| 84. | Linociera malabarica Wall. ... | Oleaceae |
| 85. | Litsea deccanensis Gamble. ... | Lauraceae |
| | ,, *tomentosa* Heyne. ... | ,, |
| 86. | Machilus macrantha Nees. ... | ,, |
| 87. | Madhuca indica Gmel. ... | Sapotaceae |
| 88. | Mallotus albus Muel-Arg. ... | Euphorbiaceae |
| 89. | ,, philippensis Muel-Arg. ... | ,, |
| 90. | Mangifera indica Linn. ... | Anacardiaceae |
| | *Mappia foeiida* Miers. ... | Icacinaceae |
| 91. | Mappia ovata Miers. ... | ,, |

| | | |
|---|---|---|
| 92. | Melia composita Willd. ... | Meliaceae |
| 93. | Meliosma simplicifolia Walp. ... | Sabiaceae |
| 94. | Miliusa tomentosa (Roxb.) J. Sinclair. ... | Annonaceae |
| 95. | Mitragyna parvifolia (Roxb.) Korth. ... | Rubiaceae |
| 96. | Morinda citrifolia Linn. ... | ,, |
| 97. | ,, tinctoria Roxb. ... | ,, |
| | *Nauclea purpurea* Roxb. ... | ,, |
| 98. | Neonauclea purpurea Merr. ... | ,, |
| 99. | Nothapodytes foetida (Wt.) Sleumer. ... | Icacinaceae |
| 100. | Olea dioica Roxb. ... | Oleaceae |
| 101. | Oroxylum indicum Vent. ... | Bignoniaceae |
| | *Ougeinia dalbergioides* Benth. ... | Papilionae-Leguminosae |
| 102. | Ougeinia oojeinensis (Roxb.) Hochreut ... | ,, |
| 103. | Piliostigma malabaricum (Roxb.) Benth. ... | Caesalpinae ,, |
| 104. | Polyalthia cerasoides (Roxb.) Bedd. ... | Annonaceae |
| 105. | Pongamia pinnata (Linn.) Pierre. ... | Papilionae-Leguminosae |
| 106. | Premna tomentosa Linn. ... | Verbenaceae |
| | *Protium caudatum* W. & A. ... | Burseraceae |
| 107. | Pterocarpus marsupium Roxb. ... | Papilionae-Leguminosae |
| 108. | Putranjiva roxburghii Wall. ... | Euphorbiaceae |
| 109. | Radermachera xylocarpa (Roxb) K. Schum. ... | Bignoniaceae |
| 110. | Ricinus communis Linn. ... | Euphorbiaceae |
| | *Saccopetalum tomentosum* Hk. f. Th. ... | Annonaceae |
| 111. | Santalum album Linn. ... | Santalaceae |
| | *Sapindus laurifolius* Vahl. ... | Sapindaceae |
| 112. | Sapindus trifoliatus Hiern. ... | ,, |
| 113. | Schleichera oleosa (Lour.) Oken. ... | ,, |
| | ,, *trijuga* Willd. ... | ,, |
| 114. | Semicarpus anacardium Linn. ... | Anacardiaceae |
| 115. | Soymida febrifuga A. Juss. ... | Meliaceae |
| | *Stephegyne parvifolia* Korth. ... | Rubiaceae |
| 116. | Sterculia foetida Linn. ... | Sterculiaceae |
| 117. | ,, urens Roxb, ... | ,, |
| 118. | Stereospermum personatum (Hassk.) Chatterjee ... | Bignoniaceae |
| | ,, *xylocarpum* Benth. & Hk. f. ... | ,, |
| 119. | Streblus asper Lour. ... | Moraceae |
| 120. | Strychnos nux-vomica Linn. ... | Loganiaceae |
| 121. | ,, potatorum Linn. ... | ,, |
| 122. | Syzygium cumini (Linn.) Skeels. ... | Myrtaceae |
| 123. | Tamarindus indica Linn. ... | Caesalpinae-Leguminosae |
| 124. | Tectona grandis Linn. ... | Verbenaccae |
| 125. | Terminalia arjuna W. & A. ... | Combretaceae |
| 126. | ,, bellerica Roxb. ... | ,, |
| 127. | ,, crenulata Heyne. ... | ,, |
| 128. | ,, paniculata Roth. ... | ,, |
| | ,, *tomentosa* C. B. Clarke. ... | ,, |
| 129. | Toona ciliata Roem. ... | Meliaceae |
| 130. | Trema orientalis Bl. ... | Ulmaceae |

| | | | |
|---|---|---|---|
| 131. | Trewia nudiflora Linn. | ... | Euphorbiaceae |
| 132. | Vitex altissima Linn. | ... | Verbenaceae |
| 133. | Wrightia tinctoria R. Br. | ... | Apocynaceae |
| 134. | Xylia xylocarpa Roxb. | ... | Mimosae-Leguminosae |
| | *Zizyphus jujuba* Lamk. | ... | Rhamnaceae |
| 135. | Zizyphus mauritiana Lamk. | ... | ,, |
| 136. | ,, rugosa Lam. | ... | ,, |
| 137. | ,, xylopyrus Willd. | ... | ,, |

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# Are Termites attracted to the living roots of Eucalypt?

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## Introduction

The association of termites among the dead roots of Eucalypt trees has given rise to much speculation whether attack of termites has been primarily responsible for the death of the trees. Termites are always attracted to dead wood and other materials containing cellulose, and so, they may attack the roots of Eucalypts which have died due to various causes like drought, wounds, fungal attack and so on. To declare that termites are the first cause of death of the roots, they must have a liking to nibble at the green roots even before they are dead. The present paper is an account of an experiment conducted to verify whether termites are attracted to green and living roots of Eucalypt trees.

## Material and Method

Termites are prevalent in the soil of the Forest Research Centre campus at Coimbatore. The aim of the experiment was to attract the termites to the green roots of Eucalypt trees. The species selected for this purpose was one commonly called *Eucalyptus* hybrid of Mysore variety. This hybrid is one which is very abundantly growing in the area and has adapted well to the local conditions, in contrast to many other exotic species. Even though popularly known as 'hybrid', Quereshi's ('66) studies have proved that the so-called *Eucalyptus* hybrid of Mysore origin are mostly *E. tereticornis*. Four healthy and young plants, two seedlings and two air-layered cuttings, having a growth of about four months were selected from among a large number of Eucalypt plants growing in the arboretum of the Silviculture section. At the base of each selected plant four wooden sticks of Pillamarudu (*Terminalia paniculata* W. & A.), each 25 mm square and 60 cm

long were buried vertically in the soil, 10 cm away from the main stem (Fig. 1), the portion of the sticks below the soil being about 40 cm. The purpose of burying the sticks close to the plants was to attract termites to the vicinity of the roots of Eucalypt plants. The plants were watered periodically to ensure moisture in the soil without flooding.

**Damage done by termites**

The sticks were buried in January 1965, and one stick from the base of each plant was pulled out for examination after about an year, in December 1965. There were surface nibbling on the sticks by termites in various places, showing thereby that termites had reached the region of the roots of the experimental plants. After examination, the sticks were replaced in their original positions. In August 1966, after about twenty months, all the sticks from the bases of the four experimental plants were pulled out and examined. It was found that 10-80 per cent of the sticks below the ground level had been eaten away by termites (Fig. 2). The photograph shows the nature and amount of attack by termites on the sticks pulled out from the base of one air-layered cutting, which more or less represents the condition of attack on sticks buried under other plants as well. Some living termites were also noticed amongst the roots which were of the *Odontotermes* sp. Even though the termites had damaged the dead wood of the sticks, the living roots of the *Eucalyptus* plants growing around the sticks were not at all attacked by them. Figure 3 shows parts of two of the secondary roots of an air-layered cutting growing horizontally to a length of more than 300 cm and the tertiary roots springing from them, from the base of which the termite-attacked sticks shown in Fig. 2 were pulled out. Digging the roots of the seedlings showed that the tap roots had grown stouter and longer going deep down vertically to a depth of about 60 cm, and several secondary roots arising from them. The tap roots cannot go deep down because of the presence of kankar pan below. None of the portions of the healthy living roots were nibbled by termites.

**Growth of plants**

All the experimental plants showed healthy growth in the similar way as shown by the other *Eucalyptus* plants growing in the arboretum. None of them showed any inhibition of growth or weakness. The growth of the air-layered cuttings from the base of which the termite-eaten sticks were pulled out at the end

of twenty months is shown in Fig. 4. A comparative measurements of height-growth of the experimental plants during the course of about twenty months of observation is given in Table I.

**Table I**

| S. No. | Description of plants | | Height-growth on 11-1-'65 | 15-8-'66 |
|---|---|---|---|---|
| 1. | Air-layered cutting | ... | 101·6 cm. | 400·9 cm. |
| 2. | Air-layered cutting | ... | 81·3 cm. | 251·4 cm. |
| 3. | Seedling | ... | 71·1 cm. | 274·3 cm. |
| 4. | Seedling | ... | 60·9 cm. | 200·6 cm. |

**Discussion**

From the results obtained, it is seen that the object of burying the wooden sticks near the roots of *Eucalyptus* plants to attract termites has been proved to be a success. They have destroyed some of the sticks upto 80 per cent. Yet the roots of *Eucalyptus* plants which grew very close to the sticks were untouched by termites which go to prove that termites have no special attraction towards green living roots. All the four experimental plants grew in the normal way in heigh and girth as the other *Eucalyptus* plants in the same plot, their roots profusely spreading out horizontally and vertically. The living roots dug out were free from any fungal attack.

Penfold and Willis ('61) have speculated on the possibility of fungal association with termites providing the nutritional requirements of the termites in the infected roots. Sebastian and Subramanian ('63) have also been inclined to support this view. Boyce ('61) has mentioned the adverse effects of unfavourable soil conditions, impenetrable hard pan, abnormal fluctuations of moisture content, leading to loss of vigour or death of roots enabling fungi to penetrate them which otherwise cannot enter directly into living roots. It appears from the present experiment that the chances of termites attacking living roots of *Eucalyptus* plants are very remote. Under such circumstances the causes leading to weakness and

FIG. – 1

FIG. – 2

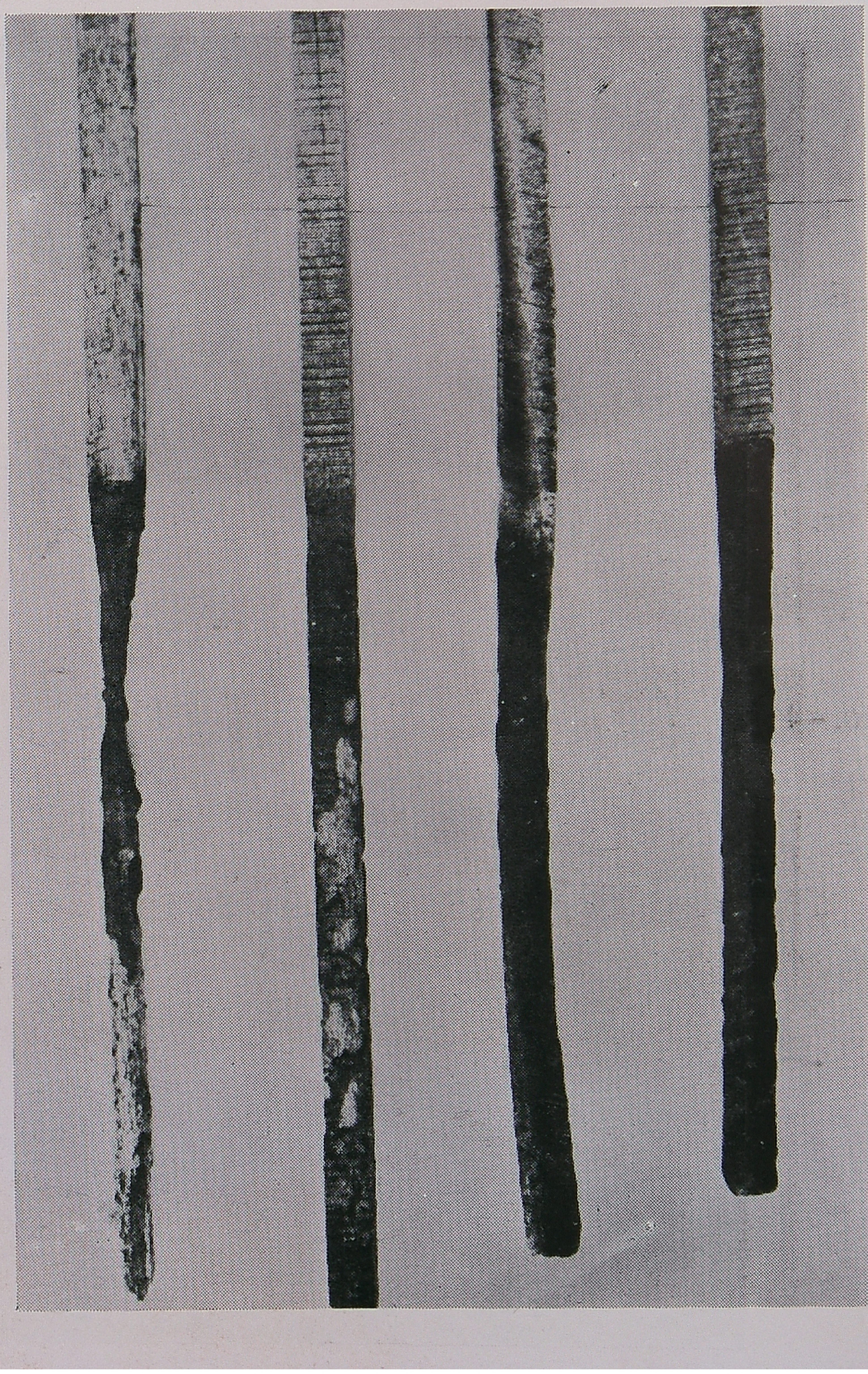

FIG. – 3

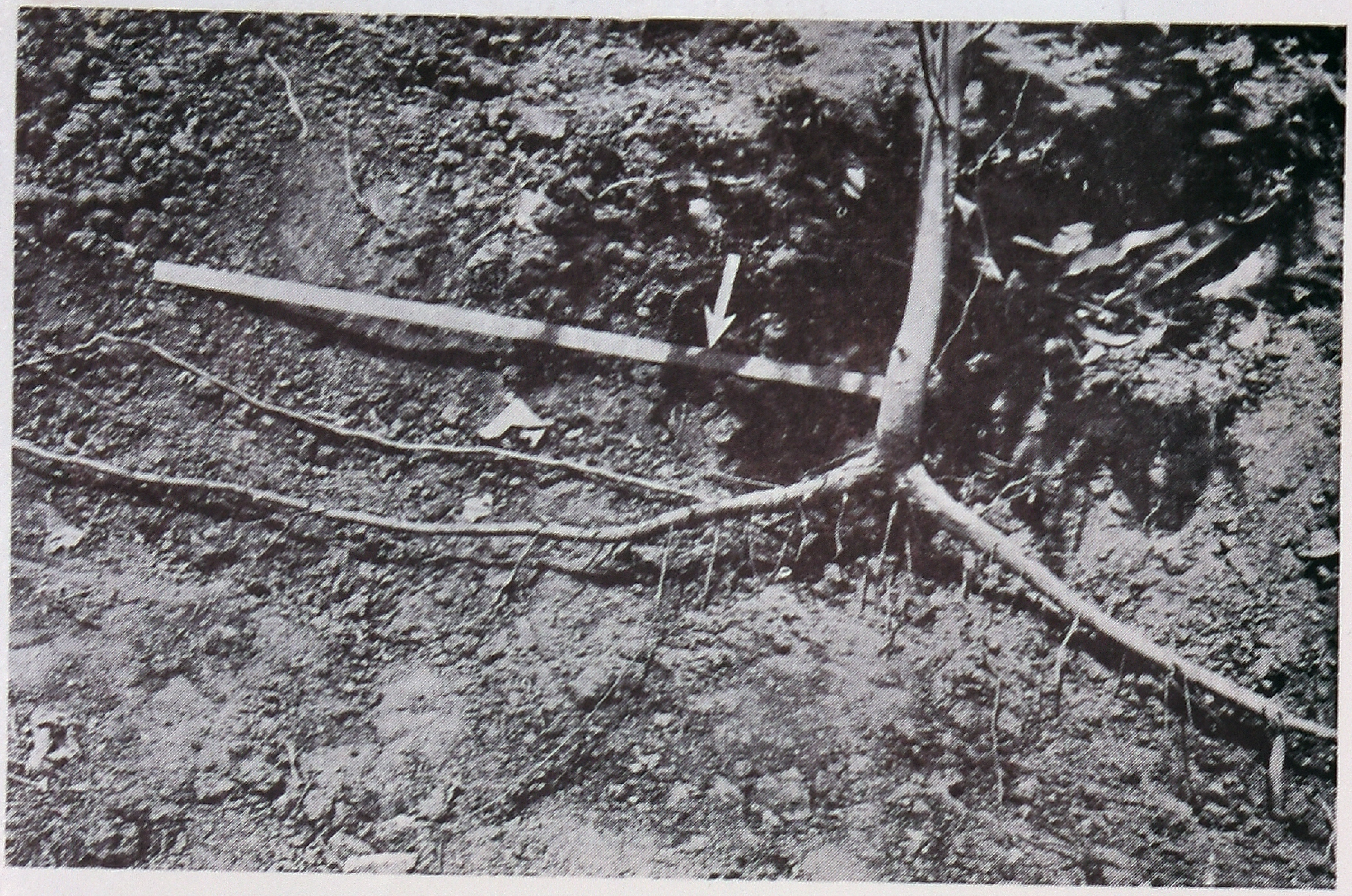

FIG. – 4

death of the roots which is favourable to termite-attack, will have to be considered. Weakness or death of roots may be due to various causes which can be understood only by a study of the interactions of the living and non-living agencies, or the ecosystem' which is defined by Huffaker and Messenger ('64) as the "interacting system composed of all the living organisms and the non-living environment, in an area sufficiently large to permit characteristic exchanges of energy and perpetuation of the component organisms". Rodewald and Witte ('64) have said that "inanimate causes, like pests, effect the physiological changes within the plant". The same authors have mentioned the inanimate factors as, *Climate and Water* (temperature, light, water, air), *Soil and Nutrition Conditions* (physical soil properties, nutrient supply), and *Chemicals* (smoke, flue gases, waste waters, chemical agents). Among the living factors, due to severe attack of cut-worms on the roots, or heavy infections of stem-borers or defoliators, the tree may lose vitality and die. In such cases preventive measures against these insect larvae or adults may save the trees from loss of vigour and gradual death. Whether other living organisms like soil bacteria, viruses or nematodes attack the roots of *Eucalyptus* plants is not yet known under Indian conditions.

In an environment where termites and fungi occur, the question may be asked which of the two can invade the roots quicker. Another question is whether fungal attack is a pre-requisite for termite attack. The indications are that fungi, after infection, can spread faster in dead roots even though termites may be present in the soil. Stern ('65) has stated that "if an attempt is made to reduce the population level of one kind of animal (for example, a pest insect) other parts of the ecosystem will be affected as well". In the present case, if the non-living surrounding, the soil, if maintained under optimum conditions of moisture, temperature and nutritional requirements, and protected from harmful, chemical pollution and physical barriers, the indications are that roots of *Eucalyptus* plants will grow well and remain healthy and active, giving no chance for the attack of termites and fungi. But the presence of other living organisms like cut-worms may alter the conditions.

Taking all factors into consideration, it is found that there is scope for a careful study of the interactions of all living organisms and the inanimate environment to elucidate many of the unsolved problems.

**Acknowledgement**

The authors wish to express their thanks to Sri M. B. Peter, Head of Biological Research for his valuable criticism and suggestions. Thanks are also due to Dr. H. S. Sehgal os Mycology branch for testing the roots of *Eucalyptus* for fungal infection.

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**Explanation of Figures**

Fig. 1. Photograph of an air-layered cutting of *Eucalyptus* hybrid under which four wooden sticks (shown by arrows) were buried in the soil.

Fig. 2. Photograph of the four termite-eaten wooden sticks pulled out from the base of the *Eucalyptus* hybrid after twenty months.

Fig. 3. Photograph showing the growth of the secondary aud tertiary roots of the air-layered *Eucalyptus* hybrid cutting after twenty months. (Arrow indicates the metre scale).

Fig. 4. Photograph showing the growth of the air-layered cutting of *Eucalyptus* hybrid (shown in Fig. 1) after twenty months. (The tree is indicated by arrow).

# Convocation of The Southern Forest Rangers College – 1966

The annual Convocation of the Southern Forest Rangers College was held in a specially erected pandal on the northern side of the college main building.

The Honourable Minister **Shri N· Chenchurama Naidu,** was received by the President, Forest Research Institute, Director of Forest Education, Dehra Dun and the Principal at the portico and conducted to the dias. The proceeding commenced after prayer.

**Shri R. C. Kaushik,** Director of Forest Education, Forest Research Institute and Colleges, Dehra Dun welcomed the Chief Guest and others.

*Hon'ble Minister, Ladies and Gentlemen*

It is my proud privilege to welcome you all today, to this Annual Convocation of the Southern Forest Rangers College, Coimbatore. We are particularly grateful to you, Sir, for the trouble you have taken to spare your valuable time to grace this occasion, despite many pressing engagements.

Owing to unavoidable circumstances, we could not approach you with our request earlier to preside over the Convocation today. We are grateful that despite this short notice you very kindly consented to deliver the Convocation address,

Conservation and development of forest resources is a field essentially needing a national outlook or at best a broad regional approach. Succumbing to accommodate individual's interests, is totally incompatible with the national and

regional needs. Even the demands of local groups have to be tempered to safeguard the broader interests. Such is the expectation from the Forest Service, which by no means is an easy job.

While it is true to a great extent that the approach of the Foresters as technicians has often to be softened to get over the immediate local social pressures, incalculable harm can result if broader interests at stake are lost sight of even temporarily. It is in this context, Sir, that we are specially happy on your having kindly accepted to be amidst us today. You have worked with the masses for over 30 years. Your experiencc in social service is vast. Your long and practical experience in sociology right from the local Panchayat level to the District and State Administration, has been of immense value, in ensuring the right attitude and approach towards forest resources in Andhra Pradesh, leading to their development in the correct direction under your guidance as Minister for Forests.

The trainees who are passing out of the portals of this institution today, to join the Forest Departments of various States, are indeed fortunate to be addressed by you at this occasion, because every word, based on your long social experience, is bound to imprint on their minds, an impact of immeasurable value.

To you also, Ladies and Gentlemen, we are deeply indebted, for gracing this occasion. A Convocation would cease to be one, without the congregation of intelligensia and the learned, whose presence alone adds the atmosphere of formality and recognition to this process of formal award of certificates on successful completion of training and education. I, therefore, welcome you all gratefully.

Now, Sir, I have the pleasure to present a brief report on the working and activities of the Southern Forest Rangers College during the year 1964-66.

The entire requirements of training of Forest Rangers in the country were met by the Northern and the Southern Forest Rangers College during the year. The total recruitment numbered nearly one and a half times of the previous year. It did result in a considerable crowding, particularly at Coimbatore, but on the whole it was possible to manage reasonably well.

Southern Forest Rangers College and Research Centre trained Forest Rangers recruited by Madhya Pradesh, Andhra Pradesh, Maharashtra, Gujarat, Mysore, Madras, Kerala and Tripura, in addition to one trainee each from Ceylon and Malaysia.

**Strength of Trainees**

The year started will 121 and 139 trainees each in 1964-66 and 1965-67 Courses, i.e., a total of 260 trainees.

Due to insufficient performance in first year, 14 trainees from 1964-66 Course were relegated, leaving a strength of 107. One trainee, Sri R. S. Parmar from 1963-65 RangersэCourse who had to be away on medical grounds was allowed to join 1964-66 Course in the second year. Thus today, 108 trainees are passing out.

From 1965-67 Course one trainee from Maharashtra left the Course as he could not adjust to the training. Five trainees, four from Madhya Pradesh and one from Madras State relegated from 1964-66 Course were allowed to join 1965-67 Course, raising the total strength of the course to 143 trainees,

Thus at the close of the year the total strength is 251 trainees.

To date, 1902 Forest Rangers have passed out of the portals of this College including 1964-66 batch. This number includes 98 trainees from Ceylon, British Guiana, Uganda, Malaysia, Sarawak and Ghana, etc. in addition to the Forest Rangers that have served or are serving in the Central and Southern parts of the country.

On 1st Nov. 1966, in 1966-68 Course, 167 trainees from the region and 4 trainees from Afghanistan are to join. Actually the Afghan students are already here. We welcome them.

**Course of Studies**

The two years' duration of the course remained unchanged.

The traditional basic structure of the course was followed spending about 60 per cent of training time on lectures and practicals in laboratories and 40 per cent of the time in the field including excursions on week-ends to the adjacent

forests and long duration tours for practicals in the various forest types of the Central and Southern regions of the country, visits to Forest Industries, the Forest Research Institute and Colleges, Dehra Dun, and a practical field Engineering camp with the Madras Engineer Group and Centre at Bangalore.

**Curriculum**

The course covered the specified syllabus consisting of Silviculture, Silvicultural Systems, Forest Management including Forest Mensuration, Forest Protection, Soil Conservation and Land Management, Forest Utilisation, Forest Engineering, Forest Botany, Surveying and Drawing, Elementary Physiography and Geology, Soil Science, Forest Law, Procedure and Accounts, Wild Life Management and Public Relations. A short course in First Aid to the injured was also given.

Time spent on each subject on lectures and practicals was in accordance with the pattern prescribed in the syllabus.

The Annual Programme of Work was considerably modified during the year to ensure a better grasp by the students of numerous and varied subjects. A system of teaching a maximum of five subjects at a time immediately followed by final examination in the concluded subjects was introduced more or less corresponding to the course-credit system recommended by the University Grants Commission for scientific and technical education in the country.

The changed system eanabled teaching of Forest Engineering by specialists from the Coimbatore Institute of Technology, Coimbatore. but the practicals were conducted by the regular instructional staff.

**Tours and Excursions**

Week-end excursions on 29 days for out door practicals around the headquarters were undertaken to study fleld botany, surveying, nursery work, tending of forest crops, field engineering, etc. Three tours each, in the first and second years of training, were undertaken covering a total of 13 and 16 weeks respectively, involving camping in the forests and other suitable locations to permit practical exercises under a variety of field conditions. These tours are invaluable into imparting a practical bias for which training of Forest Rangers in India is well-known internationally.

In addition, the tours provided an opportunity for the trainees to get first hand experience of the traditions of Forest Service over a wide spread area.

**Physical Training, Drill and Sports**

With a view to prepare the trainees to withstand arduous and rough forest life, early morning physical training, active games and sports in the evenings and long marches in mountainous and hilly forest areas during the tours continued to form an important part of the training during the year.

The cadre of Forest Rangers has to wear a prescribed uniform. Practice in drill for a smart turn out being necessary, adequate exercise in drill was ensured.

Annual Marathon race extending over 7 miles was held on 19-3-1966. Sri C. H. Mohammed Kunhi, 1965-67 Rangers Course from Gujarat State won the cup. All the trainees qualified by completing the race within the specified time of seventy minutes. The race is the prescribed test for standard of endurance attained by the individual trainees.

The College played a number of friendly matches with outside teams. In addition inter-class tournaments were held during the year as usual.

The Annual Athletics aad Sports were organised on 9-1-66. Dr. J. Thujaram Rao, Director, Sugarcane Breeding Institute, Coimbatore, presided. Srimati Rao distributed the prizes to the winners. Sri M. A. Saiyed from Gujarat State, of 1964-66 batch was declared the champion and awarded the Richmond Cup.

Durlng the year under report two football and hockay play-grounds were added to provide for the increased strength of students.

**College Mess**

A common College Mess which forms an important device to train the students in community living was run by an elected committee of the students under the guidance of an Instructor who acts as the Vice-President of the Mess.

The existing mess building being very old and inadequate, the Government of India approved construction of a new mess building during the year. The plans and estimates are expected to be finalized very soon.

**Extra Curricular Activites**

To inculcate interest in hobbies and the habit of self-development the College Association was organized as per College Rules. It continued to function efficiently during the year, entirely under the management of the elected representatives of the trainees. The Literary and Science Section, Sports Section, Magazine Section, Common Room Section, Wild Life Section and Camera Club arranged their activities separately as usual.

A well stocked students' library continued to be managed by the Literary and Science Section. A number of books were added during the year. Educational films were screened. Seminars and debates were held on different topics mostly drawn from the tours. Indoor games tournament was held. The Annual College Magazine was published.

The Wild Life Section organized visits to Wild Life Sanctuaries in Madras, Mysore, Kerala and Uttar Pradesh. A limited exercise in capturing of elephants, their training and management was undertaken.

**Health of Students**

Physical training and sports coupled with well planned diet, efficient health service and medical aid wherever necessary contributed to maintain a good standard of health of the trainees. There was no serious illness barring a couple of cases of injuries during the field exercises.

**College Library, Teaching Aids and Museum**

During the year 128 new books were added to the Library. Instruments, models, charts and other teaching aids were purchased to fully equip the College for the increased strength of the trainees.

Gass Forest Museum which displays a wide variety of exhibits of importance served as an important teaching aid. Display techniques of some exhibits were improved.

**Logging Training Centre**

This Centre was established at this College during the year as a part of the Food and Agriculture Organization Project for Logging Training. It is of an invaluable help in training of Forest Rangers.

The Project authorities have organized a demonstration today to be help immediately after the Coffee at the end of the Convocation.

**Buildings**

The inadequacy of the existing College accommodation, hostels and residences has been brought to the notice of the Government of India and provision has been made in the IV Plan programme. It is hoped that concrete action will soon be taken to ensure a phased construction programme.

**Staff**

Generally, on the whole, training staff was inadequate during the year but posts were created and steps to recruit adequate staff are in hand.

There were no changes in the staff except that Sri P. Padmanabhan from Madras State joined as an Instructor on 4th March, 1966. The tenure of 3 officers on the instructional staff was extended.

The Research officers continued to deliver lectures in their respective fields.

**Acknowledgements**

A multifaceted and broad based training like that of Forest Rangers cannot possibly be successfully organized without cooperation and help of numerous agencies. We gratefully acknowledge their cooperation, naturally.

The State Forest Departments extended their full co-operation readily, in conducting the field tours and exercises. Various senior officers acted as examiners. The bulk of the burden was shared by the Madras Forest Department. We are grateful to the State Forest Service and particularly to Madras Forest Service.

The Principal, Coimbatore Institute of Technology, Coimbatore, and his staff must be thanked for their kind co-operation in covering the Forest Engineering course in a really efficient way.

Lectures in Public Relations were delivered by staff of the P. S. G. College of Arts, Teachers' College, Ramakrishna Vidyalaya, Perianaickenpalayam, Coimbatore District, and Arts College of Ramakrishna Vidyalaya, Coimbatore District. We are grateful to them.

The Field Engineering Course was very kindly organized by the Commandant, Madras Engineer Group and Centre, Bangalore.

We must thank the Railway authorities and various transport agencies without whose co-operation the efficient movement for conduct of the course would not have been possible.

The prompt and perfect medical aid by the Medical Officer, Government Dispensary, Lawley Road, Coimbatore, and the District Medical Officer, Coimbatore Head Quarters Hospital, is thankfully acknowledged.

Lastly, I must thank the Principal and the staff of the College and Research Centre for maintaining an efficient standard of training during the year.

**Message to Students**

My dear students I congratulate you on your successfully completing the course at this College. During the training period our thoughts and actions are aimed at equipping you with the knowledge of science and technology of forestry on one hand and on the other moulding you into efficient disciplined Forest Rangers devoted to the job. This process demands firm handling which appears to be disagreeable at times. The role is similar to that of a pot-maker. He beats from outside to shape the pot, supporting inside with the other hand all the time. Silent but unlimited tenderness, goodwill and affection pitch our hopes on your future. I know all of you understand this. The teacher and the taught relationship does not end with the parting on conclusion of the course. We will always be eager to know about your success and achievements. You can expect ready help from us whenever needed. Your future welfare is as much our concern as the actual process of training. Naturally, therefore, at the solemn occasion it is my duty on behalf of all the instructional staff to say a few words by way of advice for the adage that "fore-warned is fore-armed" is completely true.

The aim is a satisfying life, a life full of success and achievements. It is not what man does that exalts him but what man would do. With enthusiasm and belief in your profession the power of achievement is unlimited. It is the struggle within you to achieve better every time that will make you worth something. The world continues to offer glittering prizes to him who is stout in heart, and acts resolutely, firmly beliving that few things are impossible to diligence and skill. Duty before self should be the motto for duty determines destiny. It is such an

aroused spirit which generates boundless endurance to sustain a purposeful endeavour leading to glorious success. You have hidden forces within you which are capable of driving you to achieve the highest. Don't fail to use them.

The expectations from the Forest Rangers who are rightly called the backbone of the Forest Service are much different now from those in the past. It is absolutely essential to remain knowledge hungrv for it is the only instrument of production that is not subject to diminishing returns.

This training has initiated you into the profession. A lot of knowledge has been passed on to you, but the great end of life is action and not knowledge. In the practice of a technology successful action must be based on scientific principles. You have yet to chew and digest the knowledge swallowed during the training perfecting the practicability. You know that practice of forestry has also been termed as an art, There are many persons who become good forests by practice and experience. Your training should assist you to acquire this art in a much shorter time and of a much better professional standard based on understanding of the underlying principles. Those who tend to treat the knowledge imparted in the training merely as a means of entering the service naturally would not be living upto the expectations. This is a pit-fall which takes a toll of the majority of less successful ones. Beware of it.

A couple of days ago Sri N. Choudhury, a student from Tripura was standing in the verandah of the College looking rather distressed. Inquiry revealed that an order from his Head of the Department to deposit all his books and notes within the College authorities, for use of his successors was the cause. His anxiety to retain these is a prize of which any teacher or set of teachers can be well proud of for it reveals that the training has moulded the mind in the right shape. All what is needed is not to permit obliteration of this impression on the mind about the value of technical knowledge during the service.

Real failure comes only when we forget our ideals, objectives and principles and being to wander away from the road which leads to the realization, Failures and mistakes that one encounters in action are natural. Don't be ashamed of these. These are actually the pillars of success provided the realization exists that is a sin to commit the same mistake a second time leading to a failure. You may get bosses who may run you down for such failures and mistakes. Don't be disheartened

and lose patience. Remember, failure of discipline is the second pit-fall which must be avoided. Discipline is really learnt and tested in the school of adversity. Don't let disappointment lead you to indiscipline. It is in such situations that the challenge really sharpens your wit and harnesses your knowledge lifting you to success.

The crux of discipline is that you must put up with your immediate boss despite his idiosyncracies and fancies which you may like the least. You should look up to him alone for redressing your grievances and help in solving your problems. The growing tendency to look up to political leaders to get things done which is contrary to the Public Servants Conduct Rules must be avoided. It may give you momentary gain but it does not pay in the long run.

In short, acquire knowledge continually, apply it in practice, be devoted to waver not from discipline, and yours will be a successful and satisfying career. I have not the least doubt that you will live upto the traditions inculcated in you by your Alma Mater.

Farewell to you:

For ever good luck and God-speed.

* * * *

After the report Shri M. B. PETER, Principal, Southern Forest Rangers College read out the results which are given below:

| S. No. in order of merit | Name of student | State | S. No. in order of merit | Name of student | State |
|---|---|---|---|---|---|
| | **HONOURS** | | 4. | K. Narsi Redsi | Andhra Pradesh |
| 1. | Ch. Muralidhara Rao | Andhra Pradesh | 5. | H. K. Thanedar | Maharashtra |
| | **Higher Standard** | | 6. | A. H. Quraishi | Andhra Pradesh |
| 2. | K. Papa Rao | Gujarat | 7. | Joseph Jogindranath | Madras |
| 3. | P. B. Durve | Maharashtra | 8. | T. Ramakrishan | Madras |

| S. No. in order of merit | Name of student | State |
|---|---|---|
| 9. | M. Palani | Madras |
| 10. | R. Chennakesavan | Madras |
| 11. | M. Ramachandran | Madras |
| 12. | M. S. Dubey | Madhya Pradesh |
| 13. | P. Upender Reddy | Andhra Pradesh |
| 14. | K. A. Rizvi | Madhya Pradesh |
| 15. | B. Sai Meera Baba | Madras |
| 16. | P. G. Kshirsagar | Maharashtra |
| 17. | R. A. Mote | Maharashtra |
| 18. | K. Rama Kumar | Gujarath |
| 19. | A. K. Nesarikar | Maharashtra |
| 20. | P. G. Borgaonkar | Madhya Pradesh |
| 21. | W. J. P. Pereira | Malaysia |
| 22. | J. D. Joseph | Madhya Pradesh |
| 23. | R. K. Chaukse | Madhya Pradesh |
| 24. | D, Dharmaraj Victor | Madras |
| 25. | S. Nowratan Singh | Andhra Pradesh |
| 26. | B. N. Pandey | Madhya Pradesh |
| 27. | A. B. Lowalekar | Gujarath |
| 28. | O. S. Srivastava | Madhya Pradesh |
| 29. | S. B. Sharma | Madhya Pradesh |
| 30. | T. F. Pagare | Maharashtra |
| 31. | S. A. T. Anthony | Madras |
| 32. | G. S. Pande | Gujarath |
| 33. | J. L. Panwar | Madhya Pradesh |
| 33. | S. B. Khot | Maharashtra |
| 35. | V. Kishan Reddy | Andhra Pradesh |
| 36. | C. M. Vyas | Madhya Pradesh |
| 37. | M. G. Vinekar | Mysore |
| 38. | S. N. Pathan | Maharashtra |
| 38. | M. Padmanab Reddy | Andhra Pradesh |
| 40. | K. Yamaraja | Madras |
| 40. | A. R. Purohit | Maharashtra |
| 42. | P. Jebadurai | Madras |
| 43. | K. V. Ghati | Maharashtra |
| 44. | H. R. Dhar | Tripura |
| 45. | K. B. Mishra | Madhya Pradesh |
| 46. | G. Vidyasagar | Andhra Pradesh |
| 47. | I. K. Mishra | Madhya Pradesh |
| 48. | K. A. Qureshi | Madhya Pradesh |
| 49. | L. Krishna Bhoopal Rao | Andhra Pradesh |
| 50. | M. L. Tiwari | Madhya Pradesh |
| 51. | B. M. Garg | Madhya Pradesh |
| 52. | M. T. Lalmunde | Maharashtra |
| 53. | P. K. Kapur | Madhya Pradesh |
| 54. | P. Chennaiah | Andhra Pradesh |

| S. No. in order of merit | Name of student | State |
|---|---|---|
| 55. | K. Madan Mohan | Andhra Pradesh |
| 56. | M. A. Saiyad | Gujarat |
| 57. | N. Choudhary | Tripura |
| 58. | A. S. Chandel | Madhya Pradesh |
| 59. | R. S. Parmar | Mahdya Pradesh |
| 60. | M. L. Parmar | Madhya Pradesh |
| 61. | V. Karthikainathan | Madras |
| 62. | S. B. Ramteke | Maharashtra |
| 63. | P. V. Deshpande | Maharashtra |
| 63. | A. Rahim | Maharashtra |
| 65. | B. D. Patidar | Madhya Pradesh |
| 66. | S. R. Bhattacharjee | Tripura |
| 67. | S. B. Kadam | Maharashtra |
| 68. | P. T. Divakar | Maharashtra |
| 69. | R. S. Pandey | Madhya Pradesh |
| 70. | R. R. Tripathi | Madhya Pradesh |
| 71. | O. P. Agrawal | Madhya Pradesh |
| 72. | H. K. Patel | Gujarat |
| 73. | D. G. Suthar | Gujarat |
| 74. | A. D. Pradhan | Maharashtra |
| 75. | R. B. Singh | Madhya Pradesh |
| 76. | K. K. Dubey | Madhya Pradesh |

| S. No. in order of merit | Name of student | State |
|---|---|---|
| 77. | M. L. Dixit | Madhya Pradesh |
| 78. | M. M. Khan | Madhya Pradesh |
| 79. | B. Narayanaswamy | Andhra Pradesh |
| 80. | M. K. Tupsakhare | Maharashtra |
| 81. | P. T. Nashine | Maharashtra |
| 82. | D. S. Singh | Madhya Pradesh |
| 83. | H. K. Durrani | Maharashtra |
| 84. | R. A. K. Yusuf Zai | Maharashtra |
| 85. | R. C. Chakrabarti | Madhya Pradesh |
| 86. | C. M. Salvi | Maharashtra |
| 87. | H. V. Chaudhari | Maharashtra |
| 88. | V. L. Bhave | Maharashtra |
| 89. | R. N. Sharma | Madhya Pradesh |
| 90. | C. S. Kalmath | Maharashtra |
| 91. | J. M. Desai | Gujarat |
| 92. | N. S. Huda | Madhya Pradesh |
| 93. | R. G. Hiwrale | Maharashtra |
| 94. | N. Manohar Rao | Andhra Pradesh |
| 95. | A. K. Pandya | Madhya Pradesh |
| 96. | J. N. Sharma | Madhya Pradesh |

| S. No. in order of merit | Name of student | State | S. No. in order of merit | Name of student | State |
|---|---|---|---|---|---|
| 97. | R. H. Mishra | Madhya Pradesh | | **Lower Standard** | |
| 98. | Ayub Ali Khan | Maharashtra | 104. | R. N. Dantre | Madhya Pradesh |
| 99. | D. S. Chhabra | Madhya Pradesh | 105. | D. S. Peteria | Madhya Pradesh |
| 100. | M. P. Gotmare | Maharashtra | 106. | K. Rama Rao | Andhra Pradesh |
| 101. | R. S. Raghuvanshi | Madhya Pradesh | 107. | R. D. Mungikar | Maharashtra |
| 102. | V. B. Gandhe | Maharashtra | 108. | K. K. Sharma | Madhya Pradesh |
| 103. | M. U. Khan | Maharashtra | | | |

PRIZE AWARDED TO 1964—'66 RANGERS COURSE

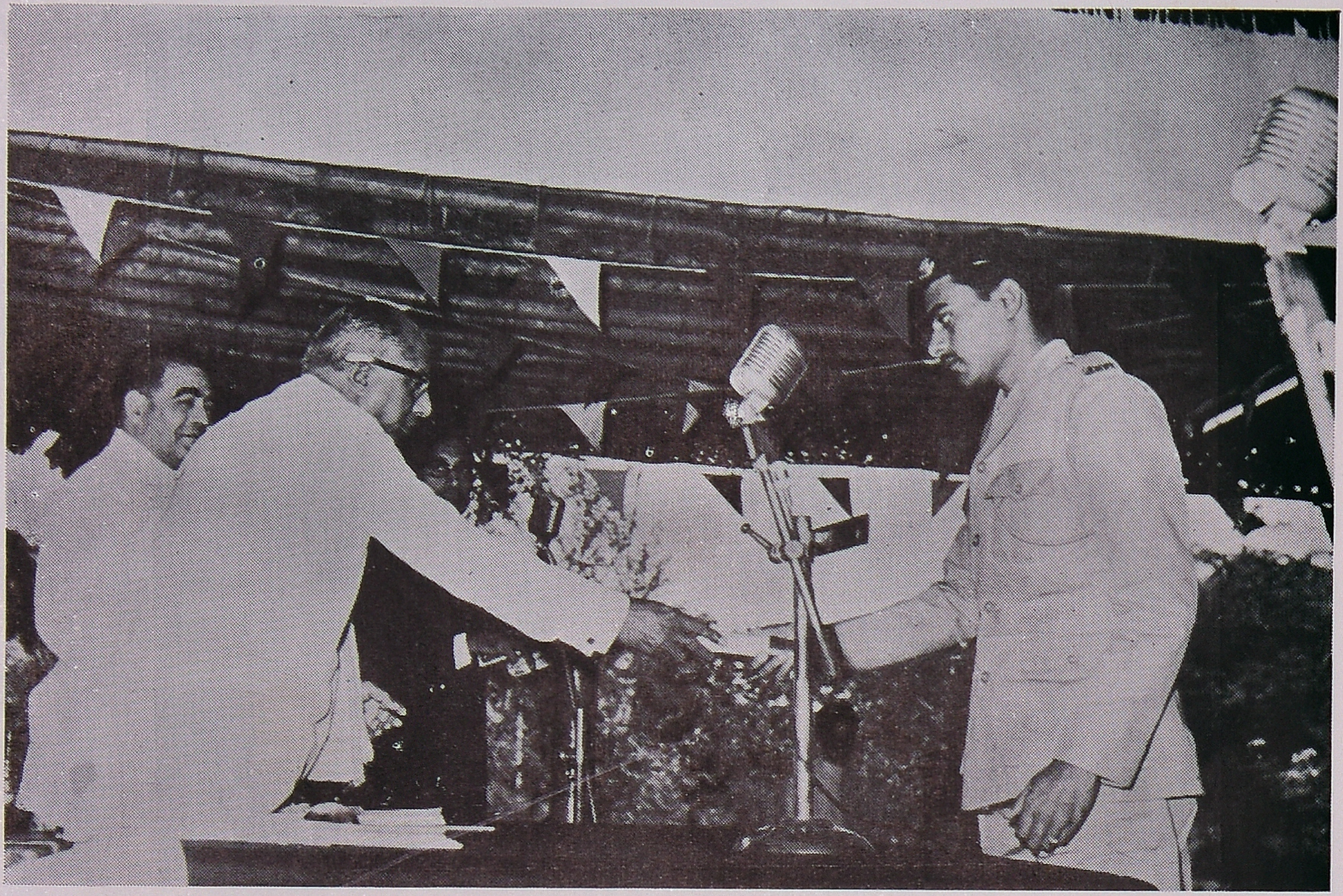
| Sl. No. | Name of Prize | Name of Winner | State |
|---|---|---|---|
| 1. | **Honour's Gold Medal** | Ch. Muralidhara Rao | Andhra Pradesh |
| 2. | **Master's Rolling Cup** (For the topmost student who does not get Honours Gold Medal) | K. Papa Rao | Gujarat |
| 3. | **The Campbell Walker Prize** (For Forestry) | Ch. Muralidhara Rao | Andhra Pradesh |
| 4. | **The Brazier Prize** (For the best outdoor Ranger) | Ch. Muralidhara Rao | Andhra Pradesh |
| 5. | **The Lodge Prize** (For Forest Engineering) | Ch. Papa Rao | Gujarat |
| 6. | **College Siiver Medal** (For Forest Utilization) | Ch. Muralidhara Rao | Andhra Pradesh |

| Sl. No. | Name of student | Name of Winner | State |
|---|---|---|---|
| 7. | **College Silver Medal** (For Forest Botany) | Ch. Muralidhara Rao | Andhra Pradesh |
| 8. | **College Silver Medal** (For Range Administration) | M. S. Dubey | Madhya Pradesh |
| 9. | **The Stracey Prize** (For Wild Life Management) | P, B. Durve | Maharashtra |
| 10. | **Indian Forester Prize** | K. Narsi Reddy | Andhra Pradesh |
| 11. | **Hajee Mohamad Khan's Rolling Cup** (For the best student from Mysore or Madras State) | Joseph Jogindra Nath | Madras |
| 12. | **The Parvathi Kurup's Rolling Shield** (For the healthiest student during the year) ** | A. B. Lowalekar | Gujarath |
| 13. | **The Mannarghat Moopil Nair Prize (Cup)** (For Marathon Race) | C. H. Mohd. Kunhi 1965—'67 Rangers Course Winner | Gujarath |
| 14. | **Amir Muhamad Khan Rolling Cup** (For the best Division in Marathon Race) | Senior Ranger "C" Divison (1964—'66 Rangers Course | |
| 15. | **The Nilgiri Wild Life Association Prize** | *1st Prize:* Joseph Jogindranath (1964—'66 Rangers Course) | Madras |
| | | *IInd Prize:* Ch. Muralidhara Rao (1964—'66 Rangers (Course) | Andhra Pradesh |

** Awarded to the student who has the best Attendance in P. T., Lectures and Games and who has secured the highest marks in Games and Sports, power of endurance and health on tours and in Marathon Race.

Arrival of Chief Guest

Hon'ble Minister inspects Guard of Honour.



Muralidar Rao receiving prize.

Hon'ble Minister delivering Convocation Address.

After this Shri N. CHENCHURAMA NAIDU,
Minister for Forests, Andhra Pradesh delivered the Convocation Address

# CONVOCATION ADDRESS

By

Shri N. CHENCHURAMA NAIDU

*Friends,*

The notable role played by the Southern Forest Rangers College in the training of Forest Rangers to man the forests of a large part of our country and also our neighbouring countries is well-known. As Minister incharge of Forests in Andhra Pradesh State, I have been very keen to visit this old and reputed institution. It is indeed a matter of great pleasure for me to be here today and particularly on this occasion when the successful candidates are passing out to play their role in the task of managing and building up the national forest resources.

It is not my intention today to elaborate on the need for conservation of forests. You know the science and you have been taught for two years all aspects of it. They are indisputable facts and no nation with vision can afford to neglect the protection of the valuable top soil and the vegetation cover. As one representing the people I would only like to appraise you of the situation you are like to face after leaving the college and the pattern of life and work that is desirable for you to adopt.

There are a few things that you should learn fast after leaving the college if you are to become a dynamic partner in the great adventure of building a New India. You are given a sound scientific education in the College. That is your foundation. Don't let it weaken. Even after leaving the College you should keep in touch with the latest advances in your science and technology. If you allow yourself to forget what is taught in this College your usefulness to the country will surely diminish.

This is an age where without public co-operation precious little of advancement in any field can be achieved. You can obtain public co-operation only by converting them into scientific minded people. Every one of you should be a nucleus for the spread of this scientific approach around you. Don't be shy of explaining the basis of your actions to the people around you. Always try to convince them and seek their co-operation even for implementing what appears an unpleasant task. You will be more successful in effecting closures against grazing and protecting your forests from smuggling and fire if you adopt this method.

Man-made forests of quick-growing trees are the order of the day in the whole world. They are raised to meet the increase in demand for fuel wood, small wood for agriculture, timber for constructional purposes, ply wood, particle board, etc., and pulp wood for paper and other industries. As an F. A. O. specialist rightly pointed out, "the World is waking up to the potential of man-made forests". Man-made forests' role in supplying timber and other forest produce is their most obvious function, but they have many other functions just as important, such as the regulation of water flow, protection of soil, etc. They have also frequently a direct impact on the every day lives of the people around. As Forest Rangers you will be directly incharge of executing many such plantation schemes. You have been taught in this College the best methods and techniques of raising these plantations. No doubt this knowledge will be very useful to you. In addition you should cultivate certain disciplines to become successful executives. The most important of them is the discipline of economics. You should know that the present times in India are difficult and the Government is interested in investing money in raising forest plantations only if you can raise them successfully and promise adequate returns. The stage of considering plantations as experiments is over. Today every plantation is a project in which you invest money to produce more money. You should understand this economic base behind our schemes and put to the best use possible, every pie that you are charged to spend in public interest.

The discipline of administration and executive leadership are the other characteristics that make a good Forest Ranger. Leadership in politics is a well-known concept. I want you to become not mere executives but executive leaders. Several Deputy Rangers, Foresters and Forest Guards work with you. A lot of labour force will be employed by you to execute the works. You should get work from them and lead them in such a way that they get a sense of participation in

the work they are doing for the progress of the country. You should handle them with sympathy and understanding and at the same time with dignity and firmness. Only then you will become a success as men and as officers.

There are a few other things that I would like to emphasize today when you are leaving the limited portals of this College and stepping out into the complex world of life outside. In the course of performing your duties every day you will come into contact with many people – people who come to complain, people who want redressal of their grievances, people who want some permit or the other. You should patiently listen to them and deal with their problems in a just way as per rules laid out by the Government. At no time you should be rude. The Government gives you a status in life and the Forest Law gives you many powers but neither of them give you the right to be rude to a fellow citizen.

It is well-known that you can act fearlessly only when you are honest. To be dishonest is to be a traitor to the country. The country needs honest and hardworking people and with your background of education and training you should set an example for others around you.

In our country public opinion has not been roused to the need for protecting and promoting forests and generally speaking, the people think of forests merely as something that "Just grows". Despite the lessons of a history of destroyed and lost forests, man still tends to treat the forest as a reservoir to be dipped into but not replenished. All too frequently his annual cut of timber greatly exceeds annual growth. Man has also established himself as the major direct cause of forest fires. As a result of repeated annual fires, the seedlings and young trees are destroyed, the timber of the mature trees gets hollow, and soil erosion sets in. There is need for educating people on these issues.

The philosophy of forest conservation has to be spread among our people. You have a great responsibility in the creation of a "Forest climate" in your part of the world, so that the importance of forestry is grasped by all. You have to be a scientist, an administrator, a publicist and a lawyer if you want your forests to get the attention they deserve. Even in the most advanced countries of the world, after a long campaign, the battle still has not been won and in a developing country like ours, the pro-forestry forces have only just now started moving into the field. You as the king-pin of the department will come into intimate contact with the people. Therefore you have got a large part to play in this campaign.

Such is the task before you young men passing out today. As Forest Rangers you will be part of an old service having high traditions and a glorious history of achievements. Yours will be in a key position in the organisation and you have an unlimited scope for achievements. I hope you will make use of these opportunities.

I congratulate you all for successfully completing the course and wish you a life full of achievements.

JAI HIND!

The function came to a close with the vote of thanks by

Shri T. N. SRIVASTAVA,

President, Forest Research Institute and Colleges, Dehra Dun

*Hon'ble Minister, Ladies and Gentlemen,*

It is my pleasant privilege to thank you all for responding to our invitation and joining us at this occasion to make the function a succes. I am particularly grateful to you, Sir, Minister for Forests and Municipal Administration, Andhra Pradesh, for agreeing to spare your valuable time and to address this Convocation at a short notice. This evinces your deep interest in the forest management and forest services of the country. I may assure you, Sir, that your presence amongst us has been a source of great encouragement to us all and a matter of pride to the outgoing students, whose Convocation you are presiding upon. The illuminating address delivered by you should make a lasting impression on these students and help them in steering their future career successfully.

Addressing the inaugural session of the Central Board of Forestry at Simla on 15th October, 1966, where you, Sir, were also present, Shri C. Subramaniam, Union Minister for Food and Agriculture observed that Rs. 122 crores will be spent during the IV Plan for the development of forests and forestry. This amount is more than double of the III Plan allocation. It is proposed to raise over a million acres of plantations with quick growing species, as a centrally-sponsored scheme, at a cost of Rs. 28 crores, to meet the industrial requirements

of the country. The success of these plantations, as you have very rightly mentioned, Sir, will primarily depend on the efficiency, sincerity and hard work of the Forest Rangers in charge of such projects, as they are the officers who are in direct executive charge of such operations. It has been said that Forest Rangers are the backbone of the Forest Department and this is very correct. While the District Forest Officer, the silviculturist, the Conservator no doubt do the over-all planning and give guidance on techniques. etc., and the staff lower in rank to Range Officers, viz., Deputy Rangers, Foresters, Forest Guards, etc., carry out the duties and responsibilities allotted to them; yet it is the Range Officer who has to muster his technical acumen and ability both to coordinate and supervise the work at various levels and to implement the techniques efficiently and promptly according to schedule, without which desired success cannot be achieved. It is for these considerations that the State Forest Departments have made a demand for training of about 1,650 Rangers during the five year period of the IV Plan. Training for Forest Rangers has been provided by Government of India at two centres, viz., the Northern Forest Rangers College at Dehra Dun and the Southern Forest Rangers College at Coimbatore. For the ensuring session an allotment of 186 candidates has been made to this College at Coimbatore. This number is about three times the normal. However, every effort is being made to cater for the increased demand; as, out of the total allocation of Rs. 1,80 crores for the development of the Forest Research Institute and Colleges during the fourth plan period, as much as Re. 1 crore has been ear-marked for expansion and strengthening the training capacity of this College at Coimbatore and the two colleges, i. e., the Indian Forest College and the Northern Forest Rangers College at Dehra Dun.

On such an occasion it would not be out of place to take stock of our problems, needs and requirements in the realm of forestry, with particular reference to the part which forests have to play in the national economy of the country. It has been adjudged by experts that for the balanced economy of any country, 1/3rd of the land area should be maintained and managed as forests. As against this target, we, in India, have only about 1/5th of the land area under forests and that also is not well distributed but confined to particular regions. Though, our forest policy advocates increase in the forest area, it appears well nigh impossible in the face of present increasing tempo of industrial development and the ever-mounting pressure of population. The dams and reservoirs which are essential for augmenting hydro-electric resources and irrigation facilities swallow considerable chunks of forests wherever they come into existence; and so

is the case with many other multi-purpose programmes in connection with developmental activities. What makes the position more alarming is that even those forest areas which have so far escaped the ravages of such onslaughts are mostly faced with excessive and very heavy demands, for grazing by the ever-increasing cattle population in the country as also are over-burdened with rights and concessions; and thus are fast depleting in quality and quantity of the stocking. It has been estimated that the total growing stock of our forests in 2,138 million cubic metres corresponding to a stocking of 28 cubic metres per hectare, as against the average world's stocking of 110 cubic metres per hectare. The annual increment or yield of our forests per unit area is only a fourth of the world's forests. The position is thus not at all satisfactory. On the other hand, the annual demand of industrial wood and its products like pulp and paper, newsprint, plywood and boards, etc., is increasing rapidly; and is estimated to increase manifold in the next ten years. If the deficit is to be met by imports, it would be a considerable drain on our foreign exchange resources. Besides, the requirements of the people for fuel and housing material will also have to be met progressively for the fast increasing population. Equally significant are the after effects of denudation of forests in catchment areas of streams and rivers resulting in devastating flood in the plains and the fast silting up of reservoirs constructed at great expense. These factors pose a serious threat to our national economy. All these facts would show that we can no longer afford to have an attitude of *laissez-faire* towards the preservation, conservation and development of the forest resources of the country.

The foresters in the country are thus faced with a difficult situation. Intensive forestry based on sound scientific principles are the need of the day, but this alone would not be enough to achieve the desired results. As the Hon'ble Minister has said in his learned address there is a need for missionary zeal to arouse forest consciousness among the people, without whose co-operation and understanding the implementation of forest policies are remote expectations. While congratulating the students, who are passing out today from the portals of this illustrious institution, I do hope and expect that they realise the gravity of the situation and are fully conscious of their duties and responsibilities as custodians of the forest wealth of the country. The debt they owe to their *Alma-mater* is to leave no stone unturned in the cause of the development of forests and forest resources of the country and thus bring pride and and glory to the Institution where the foundation of their future career has been laid. I would like to impress

upon them once again to make a careful note of the precious and most practical advice given by the Minister, which, if followed would bear rich dividends.

Addressing the students from the neighbouring countries I would say that the position concerning the forest economy in the developing countries is more or less the same and they would also be faced with diverse problems which are to be tackled with courage and determination. The awareness and anxiety of those concerned with the major natural resources—the forests—all over the world, that its management should both reflect in and contribute to the amelioration and growth of the present day world, is evident from the fact that the VI World Forestry Congress held at Madrid (Spain) in June, 1966 adopted for its deliberations the major theme of "the role of forestry in the changing world economy", and the F. A. O. took considerable pains to collect data on the World Trends and Prospects in wood, which have been published in Unasylva and formed the basis of discussions.

While concluding, I would once again express our gratitude to you, Sir, for your presence amongst our midst and for the inspiring and encouraging as well as a very instructive address you have delivered. I also thank the ladies and gentlemen who have graced this occasion by their presence and have lent charm and due importance to it. I also thank the Head of Biological Research and the Principal, Southern Forest Rangers College and his staff for the excellent arrangements made on this occasion.

# Notes on the Forests of Biligirirangan hill ranges, Mysore State

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Biligiri Rangan hill ranges are located between latitude 11°5′ and 12°5′ N and Longitude 77° and 78° E in the south-east corner of Mysore State. They are somewhat discontinuous, north to sou h running hill ranges, varying from 600 — 1800 M. in altitude and form the border between Chamarajnagar and Yelandur Taluks in the west, Kollegal taluk in the north and east. of Mysore State in the south Satyamangalam taluk, Coimbatore District of Madras State. The chain of hills are aloof and isolated from both the Western and Eastern ghats. From any of the peaks, they present a Vista of smooth green hill-tops, contrasting with the patches of dense forests on the slopes and in the valleys in between the entire picture again in sharp contrast with the flat plains, dotted with hamlets, streamlets and rivers and farm lands.

Biligiri Rangana Betta with the ancient temple of Biligiri Rangaswamy on the very top has been a place of pilgrimage from very ancient days. The forest is the home of the Sholigars, a tribal people peculiar to this area and also of the elephant, the bison, and the tiger. It has attracted big-game hunters, and at Kyathedevaragudi the former Rulers of Mysore maintained a hunting lodge, now converted to a Forest rest house. At Beduguli, Attikan and Honne matti, other prominent hill areas in the chain, have well establ shed coffee estates. These indicate that the forests, although not much exploited till recently, nevertheless have been subject much to Anthropomorphic influences.

Botanically, these hill ranges have remained under-explored. Although in a general way Blatter in his account of the Flora of N. Coimbatore, has included

some plants of this area, and Gamble similarly treats plants of this area in his Flora of Madras, Barnes (1944) has published a list of plants, based on certain choice collection limited to certain kinds of plants. Observations made by the author on the forests of these areas are given in this paper.

The Biligiri Rangan Hill ranges receive both the north-east and the south-west monsoon rains, with the rainfall rather heavy at the higher altitudes. Thus Beduguli has more rain than either Kyathe devatagudi or Biligiri Rangan Betta. The density and nature of vegetation is strongly influenced by this factor. At the higher altitudes, in sheltered slopes occur patches of evergreen shola forests, further down are the moist deciduous forests, and way down in the more or less wide valleys just dry deciduous forests. In all these forests the natural vegesation is seriously affected by grazing, indiscriminate timber-felling, shifting Kumri cultivation by the Sholigars and forest fire. All these factors have contributed to the alteration of the original vegetation.

The rocks are lateritic and granitic with the soil respectively being lateritic or gravelly. The soil cover on bedrock is not too deep. In the shola patches the soil is full of humus and is leech infested.

## I. Moist deciduous forests and sholas at Beduguli :

The vegetation here shows some interesting features because of its topography. Most of the areas are above 1200 — 1800 m. There are a number of small peaks like Dasaberibetta, Devagiri-betta etc., leaving deep slopes in between them. These slopes present interesting evergreen shola vegetation, and can clearly be noticed from a distance as isolated patches of vegetation surrounded by smooth hill tops. The common trees in the sholas are *Sympolocos laurina* (Retz.) Wall. ex G. Don., *Vernonia monosis* C. B. Cl., *Mallotus philippensis* M. Arg. *Cinnamomum zeylanicum* Bl., *Pterocarpus marsupium* Roxb., *Callicarpa tomentosa* (L.) Murray, *Wendlandia thyrsoides* (R. & S.) Steudl., *Santalum album* L , *Ixora notoniana* Wall., *Canthium dicoccum* (Gaertn.) Merr. var. *umbellatum* (Gamb.) Sant. & Merchant and *Schefflera wallichiana* Harms. The branches of the trees are heavily moss laden which forms an ideal substratum for the growth of epiphytes especially orchids and ferns. The trees are stunted here due to the high velocity of wind and extremes of temperature. The humus laden floor of these

sholas is practically devoid of herbs and only the luxurious, gregariously growing *Strobilanthes foliosus* T. And. forms a striking feature of the shrub stratum.

The moss laden branches of trees accommodates a large number of epiphytes the most common ones being *Oberonia brunoniana* Wt., *Dendrobium macrostachyum* Lindl., *Bulbophyllum* Sp., *Eria* spp., *Aerides cylindricum* Lindl., *Diplocentrum recurvum* Lindl., *Saccalobium* sp , *Hoya pauciflora* Wt., *Peperomia dindugulensis* Miq., *Lycopodium macrostachys* Hook. and *Pleopeltis* sp.

Just outside the sholas on the slopes above 1000 m. there is an association of *Phoenix humilis* Royle, *Artemisia vulgars* L. and *Hypericum mysorense* Heyne. They finally merge at the top to the bald hill tops and towards the moist deciduous forests below. Among these bushes are seen few herbs like *Oxalis corniculata* L., *Biophytum reinwardtii* Edgew & Hook. f. *Canscora dlffusa* R. Br. and *Scoparia dulcis* L. Thc moist rocky crevices at the tcp of the hills shelters *Didymocarpus tomentosa* Wt., *Kalanchoe* sp.. *Cyanotis arachnoidea* Clarke and *Cyanotis tuberosa* Schult. f. On the moist bed of Devakeri tank *Drosera peltata* Sm., *Ericaulon* sp. and *Polygonum plebejum* R. Br. are very common.

The areas adjoining to the Forest Rest House at Beduguli and the path leading to the bald hill tops support moist deciduous forests. Among trees *Wendlandia thyrsoides* (R. & S.) Steudl. dominates amidst other trees like *Xeromphis spinosa* (Thuub.) Keay *Careya arborea* Roxb., *Albizia lebbeck* Benth., *Grewia tiliaefolia* Vahl, *Terminalia tomentosa* W. & A., *Emblica officinalis* Gaertn., *Glochidion* sp., *Trema orientalis* Bl., *Albizia odoratissima* Benth., *Radermachera xylocarpa* (Roxb.) K. Schum., *Sterculia guttata* Roxb. *Lannea coromandelica* (Houtt.) Merr., *Gmelina arborea* Roxb., *Cassia fistula* L., *Holarrhena antidysenterica* Wall. and *Anogeissus latifoli* Wall.

In the cleared forests at Beduguli, Coffee and Eucalyptus have been widely planted right from early days. These thrive very well in this locality.

The common shrubs are *Clerodendrum serratum* Spreng., *Psychotria* sp., *Cassia occidentalis* L., *Solanum torvum* Swartz,, *Solanum gigavteu* L., *Pavetta indica* L. var. *tomentosa* Hook. f., *Solanum giganteum* Jacq., *Pogostemon*

*pubescens* Benth., *Ricinus communis* L., and *Cassia hirsuta* L. dominated by *Eupatorium* sp. and *Lantana camara* L, var *aculeata* (L.) Moldenke associated with straggling bushes of *Rubus ellipticus* Sm.

*Curcuma neilgherrensis Wt*., *Curculigo orchioides* Gaertn dominates over other herbs like *Cynoglossum denticulatum* L., *Oxalis eorniculata* L., *Rungia parviflora* Nees, *Achvranthes aspera* L., *Chasalia ophioxyloides* (Roxb.) Craib., *Ophiorrhiza harrisiana* Heyne, *Sailanthes paniculata* Wall ex. DC., *Chenopodium murale* L., *Oxalis latifolia* H. B. & K. and *Polvgala* sp.

The common climbers are *Asparagus racemosus* Willd., *Clematis gouriana* Roxb., *Jasminum rottlerianum* Wall., *Dioscorea bulbifera* L., *Smilax aspera* L. and *Polygonum chinense* L. Parasites are very rare in this locality.

**Dry deciduous forests at Kyathedevaragudi and surrounding hills :**

This area has typical deciduous forests. *Terminalia t omentosa* W. & A., *Emblica officinalis* Gaertn., *Bambusa* sp. and *Dendrocalamus strictus* Nees dominates the other trees like *Adina cordifolia* Hk. f., *Cassia fistula* L., *Tectona grandis* L., *Anogeissus latifolia* Wall., *Diospyros* sp., *Grewia tiliaefolia* Vahl, *Lagerstroemia lanceolata* Wall., *Semecarpus anacardium* L. f., *Albizia odoratissima* Benth., *Bauhinia* sp. and *Syzygium cumini* (L.) Skeels. The common shrubs are *Acacia* sp., *Eupatorinm Leea crispa* L., *Securinega leucopyrus* (Willd.) M. Arg. Climbers like *Jasminum rottlerianum* Wall., *Asparagus racemosus* Willd., *Gloriosa superba* L., *Elaegnus kologa* Sch., *Cissampelos pareira* L., *Rubus ellipticus* Sm., *Rubia cordifolia* L., *Polygonum chinense* L. and *Embelia ribes* Burm., are seen spreading over the shrubs.

The common herbaceous weeds are *Polygala* sp., *Cyanotis tuberosa* Schult. f., *Evolvulus alsinoides* L., *Curcuma neilgherrensis* Wt., *Bidens biternata* (Lour.) Merr. & Sherff., *Gynura nitida* Dc., *Kohautia aspera* (Heyne ex. Roth.) Bremek, *Oxalis corniculata* L., *Solanum nigrum* L., *Tridax procumbens* L., *Euphorbia hirta* L., *Trichodesma zeylanicum* R. Br. and *Galinsoga parviflora* Cav. Unlike Beduguli, stem parasites of Loranthaceae are very common here attacking mainly *Emblica officinalis* Gaertn., *Terminalia tomentosa* W. & A. and *Radermachera xylocarpa* (Roxb.) K. Schum.

**Moist deciduous forests of Biligirirangan betta :-**

Vegetation in the Biligirirangan betta is moist deciduous. The common trees being *Ardisia solanacea* (Poir.) Roxb., *Actinodaphne* sp., *Syzygium cumini* (L.) Skeels, *Callicarpa tomentosa* (L.) Murray *Trema orientalis* Bl., *Xeromphis spinoson* (Thumb.) Keay, *Heynea trijuga* Roxb., *Sterculia guttata* Roxb., *Wendlandia thyrsoides* (R. & S.) Steudl. and *Plectronia rheedii* Bedd. dominated by *Terminalia tomentosa* W. & A., *Emblica officinalis* Gaertn., and *Dendrocalamus strictus* Nees- On the eastern slopes towards Yelandur side for a long distance trees of *Bauhinia* sp., *Hardwickia binata* and *Holarrhena antidysenterica* Wall. dominate other trees, intermixed with purple flowered *Indigofena cassioides* Rottler ex. DC. shrubs.

The other shrubs are Strobilanthes sp., *Plumbago zeylanica* L. *Cipadessa baccifera* Miq. and *Solanum toryum* Sw. The density of *Lantana* and *Eupatorium* is much less here unlike the lower slopes.

The herbaceous undergrowth is very similar to that of *Kyathedevaragudi.*

**Aquatic flora :-**

The Someshwar tank near Biligiriranga Swamy temple presents a very good aquatic flora. There is an abundant growth of submerged aquatics like *Nitella* sp., *Ottelia alismoides* Pers., *Nechamandra alternifolia* (Roxb.) Thw. *Utricularia flexuosa* Vahl and *Potamogeton* sp. associated with floating *Nymphoides cristatum* (Roxb.) O. Kuntze, *Pistia stratiotes* L. and *Lemna polyrrhiza* L. In addition to these on the margin of the lake amphibious plants like *Polygonum barbatum* L., *Ceratopteris siliquosa* (L.) Copeland and *Limnophyton* sp. are very common.

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# The Courtship of the Indian Porcupine (Hystrix indica Kerr)

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The Indian Procupine (Hystrix indica Kear.) is the largest, blunt-faced, hare-nosed, terrestrial rodent of the family Hystricidae in the order of Placentalia Rodentia, closely resembling the common crested porcupine (Hystrix cristata) of North Africa and Southern Europe. The general colour is a grizzled, dusky black. The Indian Porcupine also bears a crest and enough murderous horny quills (modified hair) to kill a tiger. But it's head and nose are so delicate and vulnerable that a slight blow is enough to kill it. It is found all over India, from the Western Himalayas (8,000 ft.) to Cape Comorin, and Ceylon, Persia, Baluchistan, Syria, Asia Minor and Palestine. In Mysore State it lives in open scrub jungles, deciduous and Evergreen forests and prefers rocky hill sides.

Porcupines are often seen solitary or in small parties. They are nocturnal and come out to feed at night. They sleep by day in caves or rock clefts or in a burrow with a big chamber dug by them alone or by some others. A Porcupine digs its burrow with its powerful paws and stout nails and kicks the dug out earth with its hind legs and heaps it at the entrace. It also provides the burrow with two or three "bolt-holes" to make good its escape unnoticed. The bolt-holes also serve as ventilators and permit free circulation of air. In the crop season, porcupines repose in dense thickets near cultivation.

The Indian Porcupine is the biggest in size ;- Head and body 28-35 inches; tail 3-4 inches, with its spines 6-18 inches. Weight 25-40 lbs. It is keen of scent and hearing. Its eyes are so placed that it can look backwards as easily as forwards. But it cannot make out stationary objects beyond 50 yards. It is

intelligent and smart and hard to trap or poison. The Wild Porcupine is so "suspicious" that it scarcely tastes new foods, and this incidentally, makes it difficult to poison it. Poison concealed in an onion or Potato is detected and left untouched. This proves that the smelling organ is more sensitive than the eyes. It grunts like a pig and often makes the same noise while charging which it does backwards or sideways with spines erected. It has an odd whim to wail aloud suddenly.

The porcupine has its teeth on the premaxillary and maxillary bones above mandibles below and are divided into the long incisors in the front and the grinding molars behind. The incisors are sharp and chisel-like, usually of yellowish hue. They are used for nibbling and growing the food. There are two in the upper jaw and two in the lower. But the wild hares and rabbits bear four incisors in the upper jaw — a larger anterior pair and a smaller pair set behind them. The incisors arise from permanent pulp in deep sockets, so that they continue to grow throughout the life time of the animal. They do not wear out through long use. Externally they are covered with a facing of hard enamel of yellowish colour on their front surfaces. As the Porcupine gnaws its food the soft dentine of the teeth wears out, while the sharp cutting edge of hard resistan enamel remains. Enamel is the hardest tissue with a high content of minerat salts and their crystalline arranagement. Canine teeth are absent, as in all rodents and a wide gap (diastema) seperates the incisors from the grinding teeth. There are four molars or griuders on each side of each jaw, cxhibiting intricate grooves or foldings of the enamel on both the internal and external sides. The molars also like the incisors, do grow throughout life from persistent roots. The Porcupine's mouth is adapted to prevent splinters of wood and other ineuible things from entering it. The hairy skin of the face extending into the mouth devides it into two parts. In the first or outer division are the incisor teeth, in the second or the inner the molars, and only a small opening joins the two chambers. The cheeks with their hairy lining act as a sieve. Through this sieve finely chopped particles of food get into the inner cavity of the mouth.

The wonderful movement of the lower jaw in the act of gnawing is rendered possible by the shape of the condyle of the mandible and of the squamosal bone of the skull with which it articulates. The condyle lies longitudinally and the squamosal is flat behind it, having no downward (Postglenoid) Process such as is found in nearly all other mammals. The mandible can be freely moved forwards

and backwards, thrusting the lower incisors as gouges against the object gnawed as well as upwards and downwards, and to a more limited extent from side to side. Muscles are present for closing the jaw and for drawing it forward and back, while combinations of these produce the rotation.

The skull has a large infra-orbital foramen. The muzzle is short and broad. The lip is divided and the ears short and rounded. The anterior feet have four toes and the hind feet five toes, all bearing thick, strong mails. Toungue is rough. The short stumpy legs are seldom seen between the quill boosted body.

When a headlight is flashed on the face of a porcupine at night it rushes to a nearby bush and stands still for a moment. Then with a threatening look it erects all its quills and rattles them together by a quick waving of its tail, at the same time thumping its feet petulantly on the ground. This rattling of quills evidently expresses its surprise and annoyance and a warning to be away from it. Next, it will let the outspread quills fall back nearly flat upon the body with their point directed backwards. Then again, it looks round its tracks, turns suddenly and bolts away into some other thicket.

Porcupine's quills arise from the crown as a dense crest and they have easily bent spines, backwardly directed and highly erectile. The crest of quills has no protective function. The fore-part of the body bears 6-18 inches long, thin, resilient quills. Underneath these long quills the entire back and sides are covered with short, stout, strong, sharp-pointed quills which can inflict deep wounds. These quills have deep brown or black and white bands. Above the powerfully sinewy tail are the all-white quills which are very sharp and dangerous and at the tail-tip are the long, thin stemmed rattling-quills which are hollow uniike the other quills. In all, the porcupine has about 30,000 quills. The quills are loosely inserted in the skin, and often, on being vigourously shaken, get detached. The old fable of a porcupine being able to 'shoot' its quills like arrows or darts at a foe, as if it were an ancient archer is quite untrue. It can lash out quickly with its tail and jab many quills in an adversary. If it falls into water, its air-filled quills keep it afloat. If it tumbles down, its quills cushion its fall. Damaged or moulted quills are replaced. A new quill regenerates under the old one and dislodges it within a few months.

A rattling tail, the bristling and unbristling of the body quills and puffing grunt somewhat like a Pig serve to confuse the enemy,

The easy way of watching porcupines is to sit over their burrows on a bright moonlit night, in an open forest. They roll out of their underground dwellings half an hour after dusk. While coming out they rattle their hallow-quilled tails and the rattling noise can be heard. They then set out briskly in the forest and plantations singly or in pairs or families, puffing and moaning and mewing and occasionally grunting in search of food. Porcupines are herbivores and feed on grains, fruits, tender tips of leaves, mealy tubers, tender bamboo seedlings and also much harder grasses and inner bark and roots of Bombax malabaricum, Boswellia serrata, Cassia siamea etc. They relish the salt contained in the wood. They are very fond of gnawing the roots of Cassia siamea plants as the Chital (Axis axis) are of browsing leaves of Sandalwood Plants (Santalum album) raised along the inspection paths in Teak and Eucalyptns plantations in Mysore State. But the damage they cause to plants is insignificant. In Uttar Pradesh Porcupines are looked opon as pests. A reward of Rs. 10/- is paid for killing them because they damage forest trees by girdling them. This looks to be a very drastic step till their precise food habits and the extent of damage to forest trees are estimated by the Forest Department or the Wild Life Staff.

Porcupines sometimes raid gardens and cultivation and cause damage. Their sharp, continually growing incisors and large molars can gnaw and chew anything - it has been seen in the jungle to gnaw elephant's tusk (Elephas maximus) soon after its death, dropped antlers of Chital (Axis axis) and Sambar (Rusa unicolor) and horns of dead bisons (Bibos gaurns. H. Smith) and their bones. Gnawing of food is accomplished by the lower incisors, the uppers serving merely as hold fasts. Many kills by Tigers are obtained near salt-licks where quantities of bones and horns, gnawed by porcupines are found. The entrance of a porcupine's burrow is also often strewn with bones. The Calcium, and lime contained in tusks antlers and bones help growth of quills. Occasionally rusted pieces of iron also are noticed near the burrow. These pieces also are gnawed by porcupines.

Porcupine has an enormous intestinal sac, the Caecum (lying between the small and large intestines) in which the food stagnates while the cellulose of the grasses and roots and other constituents refractory to the action of the animals own juices are broken down by the enzymes of symbiotic bacteria.

Porcupine flesh has a flavour something like pork. It is much esteemed by Tiger (Panther tigris. Linn.), Leopard (Panthera pardus. Linn.), and Gir lion (Panthera leo Persica. Meyer) and some people. Hanley in Assam has recorded to to have seen a tiger digging a porcupine out of a burrow at great speed, flinging it out of the earth in less than two minutes, although he had to dig down three feet to get at it. It is a wonder why that Porcupine did not escape from one of the "bolt holes" of the burrow.

Tiger and Leopard are at times mortally wounded by the Porcupine quills, which pierce deep into the body of the killer. In the forests dead leopards and tigers have been found with quills stuck in chest, paws, mouth, throat, neck, under the skin of the back, liver and lungs. Leopards, which kill many more Porcupines than tigers, catch them by biting their unprotected heads but even so leopards often suffer from quill wounds. A tiger fells a porcupine by a hard hit with its sinewy paw on its head which is so sensitive and vulnerable. The backward line of the body and back quills make it risky to approach the Porcupine from behind without danger of being pierced through. The Porcupine is a pugnacious and agile rodent and fears no enemies. It has an easy defence. It stands still with its heads bent and its nose between its forepaws for a moment and turns round and rushes backwards and charges suddenly raising its quills and clashing its hindquarters against the Tiger or leopard and flips vigourously its quilled tail jabs the quills as deeply as possible into his palm, head and nose and fore-quarters and then rushes forward again. The short, solid. white quills with lheir recurved edges set above its hindquarters strike and get embedded deep in the Tiger's body. This action is performed so rapidly that, in the heat of the battle, as it were, it gives an impression that the Porcupine has shot its adversary full of quills. The tiger cannot easily pull out the quills with his teeth and suffers inexorable pain. Quill-wounds cause crippling disability, thus preventing the tiger from hunting its normal prey. The tiger often becomes a man-eater. In a similar encounter with the crested Porcupine in Africa many a lion turns out to be a man-eater, for, crippled by quill wounds, he cannot catch his normal prey. The crippled lion prowls in the vicinity of villages and preys on men until he is shot dead. The man-eating Tigrees of Mukteshwar shot by Corbett in an encounter with a Porcupine, not only lost an eye, but was also pierced by some fifty quills in the arm and pad of the right foreleg. Many quills after striking a bone had twisted as an U, with the point and the broken-off end quite close together. Pus filled sores were formed where she had tried to pull out the quills with her teeth.

A porcupine was seen to attack a leopard, while both were drinking at the same pool, and drive it out; and another killing a leopard by piercing its quills into his head. Leopards themselves despite their immense strength and agility are not safe from the attacks of Porcupines.

Although there are no close companions among them the Porcupines treat one another with mutual tolerance. They have flexible social habits. One day a batch of four or five may move freely together and stay in one of the burrows or dens together; next day two or three or a family party. Many are solitary and like to sleep alone.

After foraging in the forest or a plantation, the male Porcupines gather at a place and enjoy wrestling, of course without interference of their quills. They enter into the game if that is welcome. They force each other and stand upright. One of them wheels and suddenly, catches the opponent and bites his neck. Then the one whose neck is bitten and held wriggles away and escapes. He is also at the same time chased. The male Porcupines like to challenge their females also provided the game is welcome. The females play quite a cautious game and do not yield easily to the male members.

During October and November certain internal changes occur in the body of a female Porcupine when she desires to receive a male. She is in Pro-cestrus-the follicular phase or "coming into heat". She begins to whine in a soft subdued tone. The rutting males also grunt aloud. They fight frequently with each other but not now with the female. The female in her turn feels restless. She roams about touching or rubbing against rocks, tree stumps or ground and leaving traces of her curious sc nt of her urethral discharge on them. After she puts her scent on the ground, one of the male Porcupines who happens to pass by picks that bit of earth and smells it. But no male pursues her. They let her alone until she herself beckons that some one of them is acceptable. During the pro-oestrous cycle which precede the true cestrus some of the ovarian follicles start to grow. The wall of the vagina thickens and the uterus gets ready to receive the embryo. The uterus wall also grows and thickens and it is better supplied with blood. The uterine glands lengthen. The ova in the follicles of the ovary ripen rapidly through the pituitary gland. Some of the superficial cells of the vaginal epithelium are shed into the lumen. At this stage of the cycle in October the female Porcupine becomes jumpy, active and

more frenzied. She goes around dragging a stick, and walking upright or rolling on earth. The male Porcupine too experiences a season of rut, corresponding to the oestrus of the female In the rutting male the testes, Prostrate and other glands of the genital system enlarge and become active. The rutting males have similar solitary diversions for some time. During November the female becomes quiet and subdued. She does not eat properly. She mopes. She then joins her chosen male and spends her time sitting by his side – But not for long.

At last, the female Porcupine from Pro.oestrus reaches the climax of the cycle. She is in true oestrus. During this time ovulation usually occurs spontaneously. The ovum is shed from the Graafian follicle close to the opening of the oviduct. The eggs or ova pass down the oviduct. Now, the time of coupling has set in. Rather surprisingly and suddenly the female Porcupine comes out of her moping mood. She is quite receptive to mating. She takes the initiative. She shows her ardour and willingness to the male of her choice and starts a brief mating interlude. She sniffs him in significant ways. He responds. They touch noses and retreat a few steps, stand upright, walk towards eaeh other and touch noses again. This touch is the signal. She submits in her soliciting posture and the male is atop her. She is co-operative. She flattens her quills and draws her tail over her back so as to enable him to lie on its soft underside. All the ame, this is the one supreme occasion when the female has the full control of the situation. She tolerates copulation. The male does not restrain her, as the males of some species do by clasping the females or biting the fur of her neck. Copulations lasts two or three minutes and is repeated during the course of some five hours or so. It may be significant that in this case for successful penetration and sperm liberation the male must mate a number of times. Soon after the copulation the female takes leave of this male. She does not also join other males until her next oestrus from now. Oestrus or heat coincides with the maximum follicular development and is caused by estrogen.

Among Porcupines there is not such an elaborate, prolonged emotional preparation for courting and accepting a male. It is the oestrous female's alertness to wait for the very nuptial day when she happens to be ready to receive the male as her oestrus is of a fleeting duration when receiving the male will result in insemination, fertilization and pregnancy. The sexual mating is achieved by the influence of seasonal changes in the environment in the Tropics and the quality of food available in the region to satisfy the extra needs of the young when they are born. The period of gestation is 112 days. The female Porcupine gives birth

to from 2 to 4 young ones having much the appearance of small guinea-pigs in March or April in a nest made of leaves, grass and root fibres in a burrow or den. They are lovely little creatures. They have their eyes open when born, and are able to run about at once and reach their mother's four mammae which are situated on the ribs behind the shoulders. At first, their spines are tiny and hairlike, half an inch long, extremely soft and flexible, but they harden in about ten days and sharpen as they grow. The young follow their parents on their hunt for food. Parents with their young ones occupy the same burrow. Porcupines live 10 or 12 years in the Wild State. They can do well in captivity in a Zoo if their natural habit is maintained. They may breed well and live long. However, they seldom become anything like Tame.

'Red' Porcupines with quills of bright rusty red bands, partially or fully have been noticed in the Bababudangiri Hills (Harold Colam 1951). A new species called Hystrix malabarica (synonym wtth Hystrix indica) with orange coloured quills occurs in the Ghat forests of Kerala, dwelling in burrows dug in the laterite rock. The external colouration of quills may be due to an inherent specific peculiarity or to some local variation, and the direct action of particular climate, soil and food. A third species called Hodgson's Porcupine (Hystrix hodgsoni (gray) Races in India: hodgsoni (Gray), subcristata (swinhoe) occurs in the Central and Eastern Himalayas, Assam and Lower Bengal at elevations upto 5,000 ft. This Porcupine bears a rudimentary crest. There is a fourth species called Brush-tailed Porcupine (Antherurus macrurus (Linnaeus). Race in India; assamensis (Thomas) ) which is found in Lower Bengal and Assam Southwards to Malaya as far as East Borneo and also in West Africa. The Brush-tailed Porcupine is as big as a hare and rat-like in build with a foot long marked tail ending in a curious tuft of withered looking white quills. The body has a fair sprinkling of quills mixed among the brownish fur but the quills do not pierce the body of an enemy. This shows that it is less highly developed type of porcupine than the rest. It's feet are slightly webbed. It lives in swampy places. Its habits are not clearly known.

There are two species of tree Porcupines in North America belonging to the genus Erethizon. They are the common Eastern Erethizon dorsatus and the Western yellowhaired Erethizon epixanthus. They have well developed clavicles and molars with closed non-growing roots. Both the species bear an inch or two long spines concealed in long dense hair. They are robust animals reaching $2\frac{1}{2}$ ft. in length with a stout and clumsy body and broad, flat, blunt, non-prehensile

tail. The spines grow mostly on the rump and back of the broad flat tail and their tips are barbed with many reversed prickles. They are loosely attached, and when the animal slaps with its tail some quills may be flirted far off. The South American Tree Porcupines (Coendou) have long, tapering, prehensile tails, short fur, with white spines and fleshy pads on their hind feet, which aid them to clasp branches of trees. They are nocturnal and feed on the leaves and bark of the trees in which they reside.

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# Plywood

KASTURI RAMACHANDRA RAO,

Every hour of the day the man in the street comes in contact with plywood ; in his house, in train, bus or motor car, in hold or restaurant, in his office or business, plywood is now a commodity of importance to every wood-working trade and is also of such general interest that the desirability of text-book is manifest.

Parts of the tree used by plywood manufacturers and veneer-cutters.

Bole.— Stright and cylindrical boles are used by plywood manufacturers for rotary cutting, and are known as "peeler logs" flat cut or Quarter-cutveneers.

Burl.— Burls are wart like protuberances with appear on certain trees, They present contorted grain when cut on the slicer known also as burrs.

Crotch.— Formed by the junction of two large limbs or at the fork of the main trunk. Crotches are sawn or sliced and produced veneers of great beauty, generally known as crubs.

Stump.—The part of the trees where the bole enters the' ground, generally cut on the slicer or "Stay log".

**Conversion of logs into veneer :**

Rotary cutting. To the plywood manufacturer the most important method of producing veneer is by rotary cutting and probably 95 percent of his is cut in this way.

The modern rotary.— Cutters are in effect massive lathes sufficiently well bedded to withstand any shock or vibration which might interfere with the smooth action of the log on the cutting knife. The log is mounted between two centres and is revolved against a knife running the whole length of the wood.

A gear from the main drive feeds the knife towards the centre of the log and is set according to the thickness of veneer required. The rate of feed is variable and the veneer emerges between the cutting edge of the knife and an adjustable pressure or "nose bar". The length, is regulated by knives which are forced into the log ahead of the cutting knife.

Logs for rotary cutting should be straight and sound and for the most economical production, large in diameter since the the chucks supporting the logs must be of adequate diameter to avoid "chatter" or "wippage" of the log during the cutting process. When cutting or a long log the pressure of the knife on the supported wood midway between the chucks may cause the log to chatter as the diameter is reduced. This renders good cutting impossible and should this happen the log must be removed from the lathe and reduced in length.

In every log a core remains after the rest of the log is converted into veneer and the diameter of this core varies with the original diameter and clearness of the log. There are special rotary-cutters available which are designed for converting small-diameter logs. These are fitted with relatively small chucks and the core coming from these is considerably smaller than that which comes from the lathes in whlch large logs are cut. In some factories the cores from the larger lathes are reduced in length and are then re-cut on smaller lathes, producing veneers which are used for plywood cores stock or for fruit basket and similar forms of package.

At first contact with the knife, the veneer is not whole, but once the log is turned up it comes away as a continuous sheet in much the same manner as paper is unwrapped from a roll. The best quality veneer is obtained early, but *as* the knife approaches the centre knots become more frequent and larger, each defect, of course, being replaced on the venecr with every complete turn of the log against the knife. From the manufacturer's point of view and this view cannot be seriously challenged — the ideal way of cutting logs into veneer is to make the cut as thin as practicable for face veneers when working on good logs and thicker for cores when a knotty or otherwise defective log is in the lathe. The operator on the cutter must decide whether a log will produce veneer suitable for faces of cores. It will be recognized that the lathe charge hand must be highly skilled and intelligent as, in addition to this responsibility, unless he can produce veneer of even thlckness and smooth cut no amount of care in other departments will enable the factory to produce good plywood.

The modern tary cutter worked by a skilled operator is a remarkably efficient machine which will produce thick or thin veneer smoothly cut and regular in thickness. To produce such veneer, however, it is essential that the knives be kept sharp and properly ground and the knife throughout its entire length.

The function of the pressure bar is to prevent splitting compression on the wood as it is fed towards the knife. The pressure should increase gradually and reach maximum when the actual cut is being made. The thinner the veneer to be cut the closer should the pressure bar be set to the knife.

The pitch of the knife, as determined by the angle which the bevel of the knife makes with a perpendicular line through its cutting edge, should be varied for logs of different diameter ; it follows, therefore, that in order to make a smooth cut throughout the log decreases. In the latest types of *coe lathe* the necessary adjustment is automatically controlled.

It is generally agreed that it is inadvisable to attempt a cut thicker than 5mm, but "checking" as the knife "bites" into the wood is likely to render even this thickness unsuitable for other than core stock.

Thin veneer cut by a skilled worker should show little or no signs of cutting checks—such veneer is termed "tight-cut." With veneers 3mm. thick and upwards cutting checks are practically unavoidable and care should always be taken to lay the veneers with the outer side exposed, so concealing the "loose-cut" surface. Veneer should always be laid as it comes from the log and for this reason it is advisable to mark the outer side as cutting proceeds. This enable workmen at all subsequent stage to recognize the "tight-cut" a surface. Such a procedure is very essential in the manufacture of baboon plywood.

"Tight-cut" veneer can be produced more readily when excessive pressure is exerted on the pressure bar, but if this is done the veneer loses much of its flexibility. By careful adjustment of pressure bar to knife the highly skilled operator will be able to produce flexible veneer with sound back. This is essential when the veneer is used for cores in 3-ply work, the core is the foundation of any panel, and unless flexible and sound veneer is used for this work it is impossible to produce flat and satisfactory plywood.

After being cut the veneer is flattened out and dried flat, so that the outside surface is under compression strain, the inner under tension. The thicker the cut

the more pronounced are these strains; this will be more readily appreciated if one keeps in mind the fact that the veneer when being cut was, so to speak, unwound from the log. It will always "try" to assume its original curve.

Veneer cut from properly cooked logs should be sufficiently flexible to lie flat on the conveyor tables or to be wound on a spindle without splitting or cracking.

The handling of veneer as it is produced by the rotary-cutters varies from factory to factory, but whatever the method adopted the desideration is that the veneer reaches the subsequent stages in the manufacturing programme with the minimum amount of breakage.

The weaknesses of wood may be summed up thus :—

1) Liability to split axially.

2) Continual movement in size and shape with any change of humidity in the surrounding atmosphere.

3) Failure to resist shear.

By manufacturing wood into plywood these weaknesses are overcome.

# O! Beauty of the Sky Bountiful thy Duty

N. B. BHURE,
1966 — '68 Rangers Course.

Look at the birds that fly in the air and learn how happy and joyful man can be."

How appropriately and precisely Jesus has pointed out the charm and grace of the bird's flight in the sky, which itself is described as—,

"The heavens declare the glory of God; and firmament sheweth his handiwork!" This Almighiy's creation will be most delightful and elegant when beautiful birds float in it. The spectacular flight of birds in the sky has excelled all the marvellous, beautiful displays of the universe. Hence Keats has described the scene as—" A thing of beauty is joy for ever." The realization of beauty is one of the most important factors that makes a man the real Man. Birds are not only to please the man by its colourful flight, by its most romantic and appealing display, by its joyful manners, by their impressive and sweet songs, but they are of far reaching benefits for humanity. The munificent nature has endowed our country with astonishing variety of avifauna, We have 3000 species ef birds i. e., 1/10 of the number found in the whole world. Some of the most prominent and graceful species we have, are the peafowl, the magnificient grey partridge, the green imperial pigeon, beautifully coloured stork, graceful snow white egrett, interesting pelican, giant amongst the Indian birds the lammergeyer, very large and courageous eagle,......... peculiar and handsome flamingo, the gorgeous peacock, which will unanimously win the crown in the beauty competion of all living beauties of the universe.

Birds are such beautiful and enchanting subjects that knowledge of them is an achievement in itself. Respecting the beneficial role played by the birds now-a-days much emphasis is laid on birds'-protection. Many people may wonder whether it is not an over emphasis on a comparatively minor problem facing the humanity today. To clear this doubt let us examine how important is the problem and how far we are justifying it.

**Birds and Balance of nature:**

Birds play an important role in maintaining the balance of nature. In Indian region so far 30,000 species of insects have been described. Practically all living animals and plants provide food for these insects. The statistical date shows to what numbers a single pair of insects would increase to if allowed unchecked multiplication. It is very interesting to note the estimates of a canadian entomologist. He said that a single pair of 'colarado beetles' would increase in one season to 60,000,000. A cater-pillar is said to eat twice its own weight in leaves per day It is found that, a single silk-worm in 56 days eats food 86,000 times its original weight. Locusts are notorious for their prolific reproduction and enormous apetite. Thus it has become very clear from the date collected by the various entomologists that unless and until the rate of increase of insects is kept under constant and rigid check, it would not be long before all vegetation vanishes from the face of the earth. Fortunately a large amount of normal bird food consists of Insects, including many forms which are very injurious to man and all his concern. The birds not only eat the insects but they have the tendency to scratch up and destroy their eggs in vast quantities. A German ornithologist has estimated that a single pair of tits with their progency, destroy annually atleast 120 millions of insect eggs, and 150,000 caterpillars. Therefore for the happiness of man it is very essential to have the check upon the paramouut sate of increase of insects, fortunately birds are doing it quite effectively.

Rats and mice are the other vermins which are enormously endangering the welfare of human beings, They not only destroy the crops and agricultural produce but also become the carriers of fatal diseases directly or indirectly. The calculations about the abundant reproduction of these vermins is shown in a nut shell by the following figures. If a pair of rats are allowed unchecked multiplication the number of their offsprings and grand offsprings will approach to nearly 940,000,000,000 in a year. Due to the blessing of God many birds like owls feed largely on rats and mice.

Thus the part played by the birds in checking the multiplication of interest, rate, and mice is of such a paramount importance that some extremist has said that the human life could not exist for more than 7 years at the most if all the birds suddenly disappeared. Though it is a mere speculation, its significance is self explanatory,

**Scavenging and manuring :**

Several species of birds are useful agents in scavenging the country-side and forest. Especially vultures, kites and crows are bird-scavengers. These birds very speedily and effectively dispose off dead bodies of cattle and other refuse dumped just near the boundaries of villages. If these refuse and carcasses, of animals were not scavenged by birds, they will become veritable culture beds of diseases, The services of birds are of special importance during famines and cattle epidemics.

The droppings of birds also help to increase the fertility of the soil. Especially as we have seen in vedantagal locality, the inhabitants of nearby villages have long recognised the value of bird excreta (Guano), as a wounderful fertilizer.

**Flower - Pollination and Dispersal of seeds:**

In the study contrivances for the cross-pollination in flowers more emphasis has been given on the importance of bees, butter-flies and other insects, but the large part played by the bird in the same capacity has not been properly understood. Many species of birds are responsible for the cross pollination in flowers. The mechanism of cross pollination of flowers by bird is very attractive and simple phenomenon. The birds have special adaptations especially in the tonue and bill. The role of birds as pollinating agents in case of silk cotton tree and Indian coal tree is conspicuous as both plants are responsible for industrial development.

In the dispersal of seed and distribution of plant life, birds play an outstanding part. The birds are responsible for the dispersal of seeds of many species, producing edible fruits such as Ficus spps, Ziziphus spps etc.

**Birds in trade :—**

Several products derived from birds, such as meat, feather, guano, edible nest, bones, etc. arevery important articles of commerce. Collection of birds alive on properly preserved for zoolozical gardens and museums is a profitable

business. Quails. partridges and other game birds are also netted or shot for table purposes. and sold in the market yielding substantial amount to those who engage in the trade.

The plumes of white egret were largely exported to Europe for the head dresses, muffs, and tippets of ladies and for other ornamental purposes. It was as valuable as gold and had fetched fabulous price. But unfortunately this worth while decoration is not in vogue today.

There are other minor products of birds which if properly treated could be made to yield sizable revenue.

**Attraction for Tourists:**

The avifauna of India also helps to earn a handsome amount of foreign exchange by attracting foreign tourists. In all sanctuaries and National parks birds are one of the most allur ng integral part of the wild life. There are exclusive bird sanctuaries also. In vedanthangal bird sanctuary, the snow white egrets, sooty black cormoratns, big billed storks, grey herons, white ibises, snake-birds are the greatest fascination for visitors. The Srirangapatna bird sanctuery consists of open billstorks, white ibises, cattle egrets etc. The pelicanry of Kola muru in Andhra is a spot for studying pelicans. The most famous water bird sanctuary is 'Kerladeo Ghana'. The lovely sight of a snow white cattle egret gracefully alighting on the back of the rhino that is placidly grazing among the flowering reeds and grasses of Kazirangam' is a pleasing spectacle for the visitors.

**Religious, Historical, and Literary Aspect:**

The birds have attracted the humanity long time back and thus got protection from the people with the religious sentiment. 'The gorgeous peacock is the glory of God'! says a sanskrit verse. The peacock is the vehicle of Saraswati and Subrahmanya. The Garuda is the vehicle of Lord Vishnu. Our whole mythological and religious literature would be uninteresting without birds. The composer of 'Ramayana,' Valmiki, got the first inspiration of poetry by witnessing the heart breaking tragedy of 'Krounch-Vadh. Birds are one of the main characters in Æspos fables. The Jataka, Panch-Tantra and Hitopadesha, stories of our ancient literature are full of tales of the wisdom and utility of animals and birds.

Fifth pillar Erdict of Ashoka and Kautilya's Arthashastra speak about the protection of so many species of birds. Birds have also contributed in the greatest everlasting sweet episodes of the love-affairs, as the messengers of love-letters from one heart to another as evident in the case of Nal-Damayanti and Noorjahan and Jahangeer. It is recorded in history that Alexander the great was fascinated by peafowl, that he took 200 peafowl from India to Greece. Moghul emperors were greatly attracted by the beauty of pcacock. Shahajahan's famous peacockthrone was designed 'its pillars' emerald being surmounted by the figures of two pea cocks a blaze with precious stones'.

The magnificently coloured dispiay of birds has given an inspiratlon to Kalidas. Shelley was much attracted by sky larks beauty, Keats was much attracted by nightingale's song and Coleridge was fascinated by the flght of Albatross.

**Bird watching as past time**

Bird-watching is becoming an increasingly popular hobby now a days. Thus to know about birds, their habits, courtship, nesting, feeding, flying, migration and songs make the people spend a lot of time and money. Photo graphing birds and tape recording their songs have become a popular hobby for rich people who can afford time and money.

In conclusion we must consider the protection and conservation of birds. To the educated the above case do not require any eloquent advocacy, but it is their duty to educate others for the protection of birds. Our late Prime-minister. Nehru had said— 'Life would become very dull and colourless if we did not have these magnificent animals and birds to look at and to play with! Lastly to quote India's leading ornithologist Salim Ali's observation, — "The birds could exist without man but man would perish without birds.".

# Non-Vegetarian and Man Eating Plants

P, K. TODKAR,
1965 — '67 Rangers Course.

People may be under the wrong impression that eating other living organism is a monopoly of the animal kingdom. But a very interesting phenomenon found in the plant kingdom is that some of them are carnivorous in habit. These carnivorous varieties are of course interesting, but it is the large man eating types that one reads about in the literature of many countries - especially the more primitive ones - that capture our imagination with lurid visions ghastly, sucking, enfolding death.

**Non-Vegetarian Plants:**

There are at least 450 different varieties of carnivorous plants, scattered throughout the world. Most of them are tropical of semi-tropical, but there are 11 different types that live and thrive in a relatively cold climate. According to Richard Clements, the various mechanisms adopted by different plants to trap animals are the pitfall type of pitcher plants, the stiky fly-paper type of *Drosera* the steel trap of venus's fly-trap, and the most interesting, complicated and self-setting trap of *utricularia*, The animals are attracted by colour, odour and secretion of honey. It is reported that the excellent odour of *nepenthes* from the Borneo mountains which had been exhibited at the Horticultural Hall in London attracted large insects and even mice. When the animal is caught it is dissolved by the enzymes secreted and absorbed or made fit for absorption by bacterial decomposition.

From the modes of capturing the prey. carnivorous plants can be grouped under two heads, those in which there is no actual movement in trapping animals and those in which there is. The pitcher traps of *Heliamphose* which grows in

regions of heavy rain-fall in South America, *Nepenthes* seen abundantly in Ceylon and in Malabar and *Sarracenia* are examples of lhe first group. *Drosera*, venus's fiy-trap, and *Bladderwort* can be taken as examples of the second.

According to Professor Lloyed the external glands of *Sarracenia* attract insects which once inside are prevented from climbing up the pitcher by the inwardly pointing hairs, the slippery rim and the funnel - shaped pitcher sides. The insect is digested by bacterial decomposition, the bacteria being present in solution in the pitcher.

*Nepenthes* attract insects by its pleasant odour and honey. Being coloured, the insects are attracted to the slippery rim of the flower. Below the rim is an area of waxy secretions of over-lapping scales which cause the insect to slip down into the pitcher along with the sliding scales. Below this is a zone bearing digestive glands. The liquid in the pitcher does not contain any digestive enzymes before the inect is caught. But the presence of the insect stimulates the secretion of formic acid and proteolytic enzyme. It is likely that the enzyme is peptic and bteaks down proteins into peptones. In 1905 Vines found out that peptones are broken down to amino acids by erepsin and absorbed Bacterias are not presant since the pitcher solution is antiseptic.

In *Drosera* the insect is enticed by the glistening, sticky, honey-like mucilaginous substance borne on the tentacles of the leaves. If the marginal tentacles are affected. they soon begin to bend over to the centre of the leaf blade. They bring the insect in contact with the central ones,which in their turn are stimulated to secrete digestive enzymes. The tentacles do net move but communicate the stimulus to the unaffected marginal ones which now close in. In a few minutes all are bent over to the centre of the leaf and their approach is intensified by an incurving of the leaf margin. The insect is entirely covered and submerged in the secretion.

The upper half of the blade of Venus's fly-trap bears numerous course teeth on its margin and each half of its surface has three trigger hairs. If an insect happens to touch any one of these hairs, the leaf folds in a fraction of a second. The marginal teeth prevent the escape of the insect by interlocking and digestive juices are secreted. The closing of the trap is due to the expansion of the cells on the lower surface, while the other surface remains still for the opening of the trap a reverse process takes place.

The most interesting type of snare is that of Bladderwor *utricularia.* It is a water plant seen floating and submerged as well. The leaves are highly segmented and some of these segments become modified into bladders with a trap-door entrance which allows minute aquatic animals to get in but not to get out owing to the smallness of the bladder and the wonderful rapidity with which the prey is caught. Botanists found it difficult to explain its working. The problem was solved by professor Lloyd by the aid of his cine camera which took a hundred pictures in one second. The mouth of the bladder is guarded by a lower lip and an upper lip the latter of which can be drawn up to open the mouth or drawn down to close it. And in this way the prey is absorbed and digested.

In Java, there is the *Upas* tree which gives off a highly poisonous vapour. According to people who know about this diabolcal plant, no living creature ventures anywhere near it. Apparently birds that fly over it fall dead and fishes in nearby streams are also over powered by the penetrating and deadly vapour. The gum of this tree is used by the Javanese hunters for poisoning the tips of their spears and arrows that is if they can get near enough to the trees without succumbing themselves.

There is the Vampire tree of the Argentine which has a powerful sleep-inducing perfume that puts its victims to sleep before sucking their blood.

So powerful is the poison of the Manchineel tree of Brazil, that stories are told of travellers who have died while sleeping or resting under its flowers when they are in bloom. The poison is contained in the pollen dust falling from the stamens.

There is a plant poison, said to be many thousand times more powerful than arsenic or strychnine, reported from South Africa. The name of this is Adena, its effect is not only instantaneous, but it leaves no traces on the body of the victim.

In Venezuela, there is the so-called Tiger tree which hurls a painful acid at its victims. A detailed study of carnivorous plants, the structure of their organisms and their methods of entrapping animals, has helped to conquer popular ignorance and superstition.

**Man Eating Plants:**

The most famous man-eater is the Devil tree of Madagascar, which has repeatedly been seen by several travellers on the East Coast of South Africa. A retired British army officer, said that he received authentic reports of this tree while he was on the island.

According to reports, the Devil tree is a palm, brown in colour and having long tendrl-like arms, something like on octopus. The leaves are hard and spiky and fold inwards. The tribesmen told the army officer that the palm did entrap human beings and eat them.

When one delves a little further back into the reports brought by early travellers from this island it is possible to piece together the details of a primitive tribal ceremony performed by the natives. We are able to gather that a young virgin was periodically sacrificed to the Devit tree, by the natives.

Apparently this ceremony is still being carried on even today. A German visitor to the island in the latter part of the 19th century reports that he has seen the ceremony actually taking place.

What do modern botanists have to say about this man-eating plant? Some say that it probably does exist, and quote examples of smaller varieties such as the sundew or Butterwort. These two plants catch their food by making themselves in to living flytraps.

Their leaves are covered with small sticky sweet-smelling hair, which shine brightly in the sunlight. In sects are attracted by the scent and as soon as they land on one of the leaves, they become stuck fast. Then the plant curls up its leaves, completely, trapping the insects.

Once the plant has the insect in its clutches, it begins to consume it in much the same way as an animal digests its food. When the meal is over the plant uncurls its leaves and waits for the next unfortunate victim.

It can, therefore, be seen that life in plant Kingdom is in no way less interesting or less adventurous than life in animals. So it can be said with little doubt that every great tree is an invisible fountain, a verdant monument to life itself.

# Science without Conscience The Ruin of Nations

V. RANGA RAO,
1966 — '68 Rangers Course.

The rapid advancement of science has changed the world beyond recognition Its achievements, people claim, are numerous and wonderful. It has given eyes to the blind, ears to the deaf, and relief to the suffering. It has enabled man to fly like birds in the air, to swinlike fish in water, and to travel on land at an alarming speed. Machinery has lifted a load of drudgery off the shoulders of man, while the means of recreation-the gramaphone, the radio, thc talkie and television are simply marvellous.

The wonders of science are too many to be enumerated. And yet the wonder is whether science is a blessing or a curse. Nobody can claim that science has been an unmixed blessing. It seems that science takes away with one hand what it gives with the other. We may have cars. steam-ships, aeroplanes, radio sets and a hundred amenities of life, but are we happier than our fore fathers? Is the progress of science real or an empty boast? Has science advanced civilization or dragged mankind back to a new kind of barbarism?

Questions like these seem to create doubts in our minds about the so called advancement of science. It seems in the words of a poet that "knowledge comes out, but wisdom lingers". Science has bestowed agiant's strength on man but the moral sense has remained as dwarfiish as ever. No wonder, if he takes delight in using strength like a giant.

Science in itself may be harmless, even a positive blessing, for science is an unending search for knowledge, but danger lies in its use by man. Humanity has made no moral progress, it has almost continuously abused the inventions

and discoveries of science. Man has not learnt to respect his fellow-men and though scientists have conquered the forces of nature, they have failed to conquer human passions and weaknesses. Many a scientist has yielded to political or economic pressure and employed his knowledge for destructive purposes.

A few instances of the abuses of science may not be out of place. It is well known that in the sphere of health and hygiene the achievements of science are amazing. Terrible diseases like plague, small pox, and typhoid have been conquered. Wonder drugs like penicillin and streptomycin perform miraculous cures, while plastic surgery can transform ugly women into beauty queens. But do all medical researches devote their attention to rid the world of death and diseases? How can we forget the inhuman uses of medical knowledge in Hitlerite Germany or the ambitious plans of destruction by using poison gas and resorting to bacteriological warfare? What about the nepam bombs that Pakistan had used agains India recently? What an irony of fate it is, that we have better medicines and surgical instruments than ouancestors had, but we have much weaker constitutions and poorer health.

Scicentists are proud of the invention of machinery, but machinery has now becomethe master of man. It is true, production is easy and efficient, but it has led to insanitary slums, unfair distribution of wealth and large scale unemployment. Man produces vast quantities of goods, but he does not distribute them evenly. Hence the curious phenomenon of poverty in the midst of plenty. Tons of wheat in America may be burnt, although millions of men starve elsewhere. The artificial shortage of goods, hording, and profiteering are a peculiar feature of the present age. Our sense of value is strange, We worship Mammon, the God of wealth and care little for the welfare of man. Science advances, but arts, literature, religion, philosophy, all these things which make life worth living are neglected.

The worst phase of the divorce of conscience from science is seen in war. Terrible engines of destruction long range artillery, mines; 'U' boats, pilot less rocket planes and on top of all, the atom bomb and hydrogen bombs and nitrogen bombs have been inverted and the havoc caused by them is simply staggering. The first scientist that lent his helping hand in war is Archimedes in the third century B. C. Neverthless, science continued to play a decisive part in war. Some scientists who were in need of money, found out many offensive weapons a d gave them to their nations, there by getting powerful jobs from the nationalists.

Thus the greatest men like Leonardo, and Galelio relied upon their scientific skill in warfare, when they recommended themselves to the men of power for Jobs. This was a wicked, cruel, and inhuman thing on the part of such scientists. The splitting of an atom, scientists tell us, releases a vast store of energy, which can be utilized both for constructive and destructive purposes.

It is inhuman, wicked, cruel and conscienceless on the part of the nationalists who try to take revenge upon another by using these fearful and destructive weapons. The selfish and immoral pursuit of science has landed man in a most fearful plight. The spectre of war and destruction haunts the world and nobody is safe " mankind" writes Winston Churchill " has never been in this position before, without having improved appreciably in virtue or enjoyng wiser guidance, it has got into its hands for the first time the tools by which it can unfailingly accomplish its own extermination. That is the point in human destinies to which all the glories and toils of men must have at last led them."

Britain's premier seems to have pronounced the last word on their tragedy of modern civilization, a tragedy which arises mainly from the wide gulf between scientific advancement and moral growth. Indeed science is, at best mixed blessing or to put it frankly; more a curse then a blessing. It will continue to be a greater curse unless man's moral growth keeps pace with scientific advancement.

# Some Thoughts On Devaluation

P. G. NARAYANA PILLAI
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Devaluation means reduction in the value of a currency in terms of gold in relation to a foreign currency. The Government of India devalued the rupee by 36·5 percent on June 5th, 1966. The centre's decision was a change in the par value of the rupee from 18.66 grams of gold per Rs. 100 to 11-85 grams of gold. In practicial terms this means that the value of United States dollar will be Rs. 7.50 as against Rs. 4.76. The value of the pound sterling has been raised to Rs. 21 as against Rs. 13.33. The Price of a Rouble (U. S. S. R.) will go up to Rs. 8.33 as against Rs. 5.21.

**Causes**

The real value of the Indian Rupee had considerably gone down in the open market. It is proved by a continuous rise in the internal prices. The exchange rate of the rupee was artificially mantained. When we went out borrowing money from the Inter National Monetary Fund or the World Bank they had the right to say that they could not lend money at the artificially maintained rate. The authorities of International Monitary Fund and the world Bank adviced the Government that they could lend money only at the intrinsic value and not at the artificially maintained rate.

It is a fact thas in the Third Five Year Plan while we aimed at 30 percent increase in our National income our achievement has been round about 17 or 18 percent. It is also a fact that the gap between exports and imports were widening imposing a heavy strain on our balance of payment. Position more over there has been an acute shortage of foreign exchange resulting in import cuts. Since these imports were of raw materials, components and spares, curbs on imports have

led to stagnation of Industrial Production. The whole sale price during the three plan periods have risen by 80 per cent. In other words there was a heavy fall in the value of the rupee.

The Indo-Pakistan war, the conflict with China and a severe drought occurred in the third plan period. This also led to the fall in industrial production and increase in the wholesale prices.

We often forget that we are a poor country which has to strive hard to overcome poverty and reach higher standards of living. It is good that devaluation has once again brought home to us the need to recollect the basic things. The average rate of growth of population in the third plan period was about $3\frac{1}{2}$ percent. A rather heavy fall in agricultural production occurred. It is also not enough that we meet food demand from year to year but should also build a buffer stock to meet the threat of lean years. This requires a lighter rate of growth in the agricultural production. Now we are giving attention to it and taking necessary steps towards that end. A similar problem faces us in the industrial field also. Even if we had not gone in for devaluation these difficulties would have had to be faced in other ways. But the devaluation by itself would not enable us to meet the challenges facing us.

**Merits & Demerits :**

Much is said for and against devaluation. Whether we like it or not devaluation is a *fate accompli*. Mainly there is a question whether the decision on devaluation was taken on purely economic grounds, or foreign political pressure had hand in it. We feel that a question like this should be considered purely on economic grounds. It is easy to confuse economic pressure with political pressure. Devaluation affects the total economy its pace of growth, its movement towards self reliance and the rest.

To consider in favour of devaluation the following points are there namely.

(1) There will be an increase in the profitability and attractiveness of Indian export industries resulting in a great flow of resources and investment in such industries,

(2) Increase in the cost of exports will make into more profitable and attractive for people to invest in import saving activities.

(3) It will overcome price resistance to many of our exports in foreign markets.

(4) It will check inhealthy and anti social practices such as under-in voicing of exports, over-in-voicing of imports, sale of traveller's cheques in unofficial markets, remittances in the oficial markets, remittance through un-authorised channels, smuggling of gold and other articles such as cameras, watches and Transistors.

(5) With the reduction in the leakage of foreign exchange the Government's foreign exchange reserves will be strengthened.

According to Finance Minister Mr. Sachindra Choudhury this act of devaluation would restore the competitive position of India's exports and also provide a strong inducement to export industries. It would help the progress of the Indian economy. It will facilitate a better allocation of our resources and strengthen our foreign exchange position.

When considering the demerits of devaluation, They are :—

(1) It will be followed by rise in prices.

(2) It will have adverse effect in the cost of living which will go up.

(3) The students and Government scholars studying abroad will have to pay more for their education.

(4) There will be an increase in the cost of imported fertilizers as well as the raw materials for fertiliser production such as sulphur and phosphate. This will affect the Indian farmers.

(5) It will increase the foreign debt payment. India's Foreign debt would go up from Rs. 2733.86 crores to Rs. 4102.57 crores an increase of Rs. 1368.70 crores. The rupee cost of Govt. imports will go up. There will also be increase in Government foreign expenditure.

**Future :**

Now the only question left is how to over come the consequences of devaluation. The Finance Minister and all other leaders have requested consumers to fight against any rise in prices. If seemed that Government wished to throw

all the blame and censequences of their action in the trade and industry. These pronouncement would result in the long run in creating ill-will between the producer and the cosumer and may result in agitations and demonstrationsr. In every country where devalution of currency has taken place prices of consumer goods and other commodities have gone up. How could any manufacturer maintain the price-line when the cost of imported raw materials components and spares goes up by 57·5% due to devalution and more, after adding customs duty.

It is for the Government to change it's fiscal policy and adopt some other measures in order to check the rise in prices, to get the maximum advantages out of the devaluation. The following are a few suggestions :—

The Government would change its fiscal policy to keep the price of the imported raw materials etc. at the same level as before. Only then will it be possible to stop the rise in prices. At present the customs duties are ranging from 30·6 t 11·0% Government should take drastic measures to reduce it and in some cases should be subsidised. The considerable loss of revenue caused by this can be easily balanced by stopping unproductive activities and curtailing expenditure in Government administration which has grown up by leaps and bounds during the last two decades. In the interest of the country which is passing through such financial crisis it is the duty of the state to reduce its expenditure to save the country from the effects of devalution.

Secondly import of raw materials should be restricted and they should procure them in the country intrest. It is true that in many cases it cannot be alone and raw materials may have to be imported, but in hundreds of other cases it is possible. Unfortunately we are in the habit of not making efforts to produce what we can. An all India effort should be made to produce raw materials in the country.

Thirdly we should try to increase the exports. For this purpose, manufactures who are in a position to export their commodities must be given all facilities to go abroad and make personal efforts to sell their produces when ever possible.

Fourthly Government should take steps to raise the tax structure. Unbearable tax leaves no incentive to industrial effort. At a time when U. S. A. was facing the same situation and the production was going down rapidly, the tax was reduced at a rate of 20%.

Fifthly the labour policy also will have to be changed. Here the Government will have to change the labour laws and make wages, dearness allowances and bonus linked up with productivity for increasing production and reducing costs. Immediately after World War II in Germany when the Government coffers were empty a concentrated effort was made. The working hours to increase productivity were 12 or even more.

If the Government is genuinely interested, the devaluation which has apparently caused such a crisis shall become a boon to our industrial and economic progress within a few years.

Devaluation is always a painful decision to take. It is taken to correct a particular set of in balances which develop the economy over years. There is no use showing anger and getting agitated on it. We have to find ways and means to meet the challenge and shape our fiscal and economic policies to make devaluation advantageous to the country in the long run and make revaluation possible in a few years.

# Forests in National Economy

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**Before coming to the role played by the forests in our national economy,** it would be better to know what a forest is— "Forest is an area where almost all types of flora and fauna are found in their natural habitat". Besides production of timber and other forest-produce Forests indirect benefits.

Agriculture which plays an important role in the national progress, is dependent on the forests to a large exten . It is said that Agriculture without Forestry is like a child without its moth r. Forests help agriculture by conserving the soil and moisture; by preventing floods and shifting of sand and by arresting soil erosion by wind and nature. It also influences the climatic factors (Temperature, rainfall, air-currents) on which the agriculture is footally dependent.

If we think a little of our past, we will come to realise the real value of the forests. Early men used to get their food, housing, clothing, fire, tools weapons and other equipments from the forests only. Wood which is one of the most important forest-products is considered as an universal raw-material and almost all the important things of human-neeal, are made out of this. It yields power in the form of fire wood and wood-gas; food in the form of cattle-fodder and wood sugar; clothing as rayon and staple fibres; living and transport, as houses, railway carriages car-bodies and so many Engineering goods and equipments, for Schools and Colleges.

If we pay our attention towards the national-defence and communications then again the picture of forests reflects on our minds. It plays an important part in all the three main branches of our defence i, e. Army, Navy and Air-force.

The planes which make a passage in the air; boxes and carriages for ships which help in crossing the sea; the weapons and ammunitions are all made up at wood obtained from the forests.

The sleepers which are the mainorgans of railway are also the product of Forests. Timber obtained from the forests, is used for building up the merchant navy, civil air-lines and also in the expansion of telegraph and telephone facilities.

Now, most of the industries which have got an important place in the maintenance of our national-economy, are dependent on the forest-produce because the supply of raw-materials is from the forests only. Industries like Match-Industry, Plywood industry, Paper industry, Rayon and staple-fibre industry and Textile industry are completely dependent on the woods obtained from the forests. It has been estimated that the annual causumption of wood by the Match-industry is about 1,45,000 tons and expected to be just double in the near future. The Ply-wood manufactured at present is about 153 millions sq. ft. year. Like wise about 125 paper and board mills are depending upon the raw-material of the forests. The annual consumption of wood by these mills is estimated to be about 4,87,000 tons. Rupees one crore and Rupees 3½ worth of wood is used annually in the manufacture of sports goods and textile axillaries respectively.

The fire wood and charcoal which really come under the urgent needs of the people are also the products of the forests. In our country greater percentage of the fuel-wood is used for cooking and heating purposes.

Other industries which are provided with the raw-material from the forests are-lac, *rath* and *cutch*, resin, essential oils, mathematical implements. The revenue obtained by the export of lac is Rs. 10 crores annually. Like wise Rs. 2 and 3 crores worth of *katha* and *cutch* is produced annually in the country. The tanning which is one of the important forest-produced about 20,000 tons annually in our country. Apart from these some other important minor forest-products like Bamboos, Canes, Fibres, Fans, Dyes, Gums, Drugs, wax etc. play a major part in national-progress.

The average annual values of Minor Forest Products exported from india during 1954—'55 will give an indication of the role of forests in our national economy. The products and their values are follows :—

| S. N. | Name of the artides | Revenue obtained in Rs. |
|---|---|---|
| 1. | Beedis | 10,334,411 |
| 2. | Bristles, Brushes and Brooms. | 8,539,797 |
| 3. | Canes and Bamboos | 1,496,521 |
| 4. | Drug and medicines excluding chemicals | 24,534,477 |
| 5. | Edible products | 119,352,066 |
| 6. | Gums and resins | 15,440,524 |
| 7. | Oil (essential) and perfumary materials | 26,871,822 |
| 8. | Oils (vegetable and non-essential) | 100,538 |
| 9. | Lac | 106,208,465 |
| 10. | Reptile skins | 5.775,488 |
| 11. | Wax | 713,488 |

The *Minor Forest Products* are in no way less important than, Major Forest Products. This clearly indicates that Minor deserves Major attention in Indian's economic development.

The role of forests in rural economy without which the national economy is not at all possible, is not less. About 75% of the total population of our country lives in the villages distributed all over the nation and depends upon the farms only. Therefore, it is quite clear that for the progress of the country, the farmers have to be prosperous and they can progress only when they get better yield from their farms. Forests help the farmers in many ways. Farmers, due to their urgent needs and ignorance, bum the cow-dung which forms a very good farm yard manure. By using the wood as a fuel, they can save that cow-dung and increase the fertility of the land by spreading that in the forms. Thus by using the cow-dung was a mannure, they can save their money from purchasing the inorganic manures which have got only temporary effect and land. It has been estimated that cow-dung burnt as fuel in the country annually, is equivalent to 7 million tons of fertilizers. By using this much of manure, the productivity can be increased to a greater extent and that will certainly help in the development of our nation.

Forests can aiso supply the small timber for the custruction of agricultural implements and small houses. Moreover, it can provide fodder and proper grazing facilities, by which,farmers can maintain the health of their cattles and this will result in more production.

Fencing materials can also be obtained from the forests which will help in protecting the crops from grazing animals.

In addition to the above our forests give chances of employment to the persons seeking jobs. About 8 million persons are employed in forest works and allied industries based on the raw-materials obtained from the forest.

Thus the above things clearly show that our forests play a very important role in our national economy.

# Vanamahotsava

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Vanamahotsava is a National ceremony celebrated in all states of India annually. It is the tree-planting ceremony which is not new to our country. It dates back to vedic age. Even King Ashoka the great was an ardent lover of trees and his orders were to plant trees along the road sides throughout his Kingdom and to protect trees from wanton destruction. Necessity for the observance of the ceremony was not of so much vital importance to the lives of people in those days as it is today.

As we know that some years back the Minister of forests, Government of India Shri Kanhaiya lal Munshi proposed that India should celebrate annually the festival of *Vanamahotsava* as a National ceremony. What prompted the forest minister to make his proposal is now known to most of the people. The object of Vanamahotsava is to popularise the idea of ceremonious planting of trees annually and make the people tree-conscious.

Following are the main reasons for the depletion and disappearance of our valuable forests.

As civilization advanced, the forests were ruthlessly cut, without proper forethought, to make room for human habitation.

More and more forest-lands were cleared to meet the needs of the ever-increasing population and partly to set up vast townships and industries.

Due to over-population and less production of food crops vast forest areas were cut down for cultivation.

Forest adjoining the villages were destroyed by cattle because their grazing lands were brought under cultivation. Adjoining forests were also cut down to meet the demands of the public for fire-wood and small timber.

The forests were over-exploited during the emergency periods to build up our defence forces and communications. In the Second World-War, the Indian forests were over-exploited to meet the above demands.

These are the main reasons for the destruction of our forests and now we are facing difficulties.

It is said and rightly said that Forest precedes civilization and desert succeeds. History gives us numerous instances to show that lands once pulstating with life are nothing but deserts now. Such things happen only when we keep our lands tree-less. When we destroy our forests and leave the soil naked to the devastating action of heavy rains, surface run off, floods, storms strong winds and machanical damages of various types, we not only loose the fertile mineral layer of the soil but also the very source of organic material which is required for the improvement of the soil. Whenever there are no forests, particularly on the hill-slopes and catchment areas of rivers, the rivers dry up in summer. We wish to see our rivers always full of water because we need sufficient water for our irrigation and hydro-electric projects. For this we must not disturb the tree growth in the catchments. Here comes the role which every villager can play in making a contribution to National prosperity.

It is clear that we are abusing the friendship of trees. We are cutting the armsthat they stretch over our heads in loving benediction. So along with planting of trees we should also preserve what we have along public roads and avenues in parks and open spaces. One of the many objects of tree-planting ceremony is to make men love trees and forests and realize their importance. But it should be remembered that protection of trees is far more necessary than mere planting of trees. The most essential requisite to the success of vanamahotsava is to teach the general public to respect trees and forests. Hence it is the duty of every citizen of India to avoid the dangers described above. Vanamahotsava gives opportunity to each and every citizend to contribute his efforts in this respect by celebrating the tree-planting ceremony.

Total area of our country is 3267534 Sq. K.ms. out of which 783962 Sq. K.ms. are under forests. So the percentage of forest area in our country is 22·1. Per capita forest is 0·22 hectaras and potential land avaiiable for forests and cultlvation is 46%. Some of the lands out of this 46% can be brought nnder forests so as to increase the percentage of forests and thereby the glory of the country.

Actual celebration of vanamahotsava is usually as follows. This festival is celebrated in rural as well as in urban areas every year during the rainy season on a certain fixed date, Early in the morning all people gather round the planting spot. The chief-guest, gives a short lecture on the importance of vanamahotsava. Then he plants the first seedling after Puja, which is then takam up by the assembled gathering Function is made more colourful by singing hymus and songs about tree planting with the initiative in the govt. level. Various departments like agriculture, engineering and of course forest department celebrate van-mahotsava.

Importance of tree planting has been described by Henry Abbcy in the following lines—

" What do we plant where we plant trees ?

We plant the ship that will cross the sea,

We plant the mast to carry the sails,

We plant the planks to withstand the gales,

The keel, the kedson, the beam and kneee—

We plat the sheep ween we plant the tree."

In Porngal, even in public park and open spaces, there hangs on every tree an insription —

"I am the heart of your hearth on the coold winter nights the shade screening you from sun",

"I am the beam that holds your house, the board of table the bed on which you lie and timber that buiids your boat".

"I am the handle of hoe. the door of your home stead, the wood of your cradle and the shell of your coffin".

"Ye who whould pass by and raise your hand against me, hearken ere you harm me".

In India the great poet Rabindranath Tagore, who first introduced vanamahotsava in his Shantiniketan, has also brought out the relation-ship, between forest and civilization in the following words —

"We may see that in ancient India the silence of the forest did not nullify man's intelligence," but on the contrary it gave him such a spirit that the whole of India was submerged with the wave flown from sanctity of civilization born from forest and the current is still in action without any interruption".

Every person should take the following pledge and consider it their sacred duty to follow it strictly. Then and then only the real goal of vanamahotsava will be achieved —

" Born and bred in the land of Buddha and Gandhi, I give my solemn pledge to protect our country's forests and their voiceless denizens from wanton and wasteful desruction ".

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# Tourism and Wildlife

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'TOURISM' - this aspect of wild life has been highly developed in certain countries particularly, in Switzerland, France, Britain anc some other European countries. In Britain it is not only a flourishing trade but also helps to earn a big foreign exchange. As many as 10 lakhs of foreign tourists visited these countries of attraction in 1955. In the contrary we had only 43,645 foreigners to visit our country allthough we had much to offer.

In Kenya; wild life occupies a third place in their industrial trade list. In Uganda, each year about a lakh of foreigners visit the, Queen Elizabeth Natioual Park' to see the wild-animals, especially; the giant hippoes anp the birds, thereby bringing considerable amount of foreign currency.

Our country having a variety of languages, customs, costumes and colours, possesses a magnificent flora any fauna rich in splendour and variety, glorious in colours and kinds, thanks to nature's bounteous gift to India.

India exhibits a diversity of climate which cannot be found in any other counjry of comparable size in the whole world. This reflects on the richness of our forest flora and a multiplicity of forest ιypes which in it's turn influence the varied type of animal world.

We, Indian people talk too much and do nothing; we talk in one language and act in another way; we try to solve the problems of others but remain blind to ours. Discipline, self respect, patriolism-these words are new to us. Anybody can interfere in our matters of interest but we are not able to convince them that they will receive crushing replies if they do so and can stop them from further poking in our affairs. We are reluctant about important matters of immense interest then, 'What about wild life?' But to our surprise, it earns quite a lot of foreign exehange for which we are striving today.

Indian wild life has quite a lot to offer than any other country in the world. Tourism, and scientific management of wild life is still, in infancy in India. Seienti-fic management of wild life is yet to find its place in India. And exactly that is why our wild life has not been presented intheir proper perspective as our temples and ancient historical monuments.

**Important centres of attraction :**

Partly for aesthetic and recreational purposes and partly for rehabilitating species threatened with extinction like Asiatic llon, the great Indian one-horned rhino, the hunting chittah, the Kashmir stag etc. we have some National Parks, Game sanctuaries zoologcal Gardens etc.

**The lions of the gir forest :**

The magestic lion of the gir forests of junagar will greet you with it's thunderous roar. It is not less important in any respect than the African Lions. It is a unique animal of its kind and deserve a special place in the animal world. On the past, this magnificant creatures were bagged wantonly in large numbers by hunters endangering it's very survival. Now it's estimated number is a little over two hundred and eighty (280). The Government of Gujarath has been able to constitute the the gir forest as a sanctuary so that the noble lions, the emblem of India', will have a better chance of survival for the benefit of posterity.

**Great rhinos of kaziranga :**

The giant, solitary creature you will find playng in marshy places is the rhino An Indian poet has correctly described it as —

> "Fearing nothing, caring for nothing
> wonder alone, like the rhinceros"

The great Indian one-horned rhino is world famous. All the three Asiatic species of rhino out of five in the world used to be found in India. Partly due to the capturing and killing and partly due to the clearing of their habitat, the Indian rhinos have been gradually disappearing.

The horn of it is supposed to be of immense medicinal value. Not only this but it's urine tiny pieces of hide, bones etc., are also valuable the meat is believed by some to be not only palatable but also a combined passport and ticket to the land of eternal bliss!

**Lordly elephants of Periyar:**

Priyar is the veritable home of wild elephants. These giant beasts will welcome you with a loud trumpet. You can see them grazing near the edge of the lake late in the evening and merrilly swimming with the morning sun behind them. There must be at least five hundred elephants in-Periyar alone out of about three thousand in South India.

**Tiger of Corbett Nationai Park and Kanha:**

The Corbett National Park in Uttar Pradesh and Kanha in Madhya Pradesh are best places for seeing tigers. Tigers used to be nery common in India, but improved fire arms thousand candle power headlights and spot lights of Jeeps have reduced their number considerably. It is supposed that not more than four thousand tigers are left in the whole of India today.

**The colourfull and Elegant Birds of Vedanthangal:**

The bird sanctuary, 'a uniqe place' in South India is Vedanthangal, fifty four miles South of Madras City. It is a natural sanctuary, for birds since time im memorial. The colourful life returns with the green surrounding, by about January. You will find the *Barringtonia acutangula* trees covered literally with snow white egrets sooty-black cormorants, white ibises, darters and many other avial fauna.

These are some of the magnificent animals about which we can boast of proudly, besides we have the Indian gaur the buffaloes the bears, deer, antelopes, black bucks, chinkara langour and what not?

The glimpse of this charming, enchanting, marvelous beauty is itself a source of great joy. To put it in our beloved CHACHA NEHRU'S WORDS —

" The life would become very dull and colourlese if we did not have these magnificent animals and birds to look at and to play with".

**Measures to improve tourism in India :**

**Advertizement :**

Extensive advertizement is the key to the success of any scheme 'tourism' is not an exception to it. The advertisements regarding places of attraction, facilities available, concessions if any etc., should the made not only within the country but also outside.

**Access :**

The National Parks, the Sanctuaries, the hunting reserves are far away from the centres of population in remote jungles. So, to approach such places necessary transport facilities by buses, Railways and if possible air ways or any other means of communications should be made available.

**Lodging and catering facilities :**

Forest rest houses, hotels or dack Bungalows should be built in the vicinity with sufficient and modern amenities and others facilities. Most of the foreign visitors are meat eaters. So, arrangements should be made to provide them with such food. Special care should be taken in dry areas to provide tourists with drinks.

**Photography :**

It is much more exciting and difficult 'to shoot' with a camera than with a gun. So instead of hunting, photography of these lovely and marvelous creatures in their natural habit at should be encouraged. Such fine natural close-ups will not only be a feast to the eyes of the visitors but also produce an impression in their hearts.

**Hunting facilities :**

Tourists interested in hunting should be provided with the necessary equipments like guns, ammunitions, etc. andalso horses or elephants for them to ride on. The exploitation of such wild animal species should be upon choice and sound scientific management consistent with the game rules, in force.

**Excursion buses guides, Machans and watch towers :**

The forest department can extend its help in this connection. It can manage luxury buses of their own for excursions. A smart guide, fluent in English and with a full knowledge of the localities shouldbe appointed to accompany the visitors.

In Periyar, motor launches for visitors are managed by the Kerala Forest department. It is really a colourful joy to launch through it and enjoy the pleasant evening. In Kaziranga we have famous riding elephants. Machans and watch towers should be built on the edge all around the lake so that visitors can observe the wild animal world comfortably.

**Concessions to Foreigners :**

Necessary concessions should be announced to attract tourists. The Union Government has decided to abolish the visa on a bilateral basis with a few countries. The only other country to have done this is Yugoslavia which has abolished visa altogether. The Union Minister for transport and civil aviation has recently announced that even the tourist without visas would be allowed to spend a week in India on a temporary landing permit. Under the drive to increase the tourist traffic, a number of customs - regulations have also been relaxed. In addition to one duty free bottle of spirit, tourists will now be allowed to bring a second bottle on payment of duty. They are also allowed to bring 25 film rolls on payment of duty in addition to 25 duty-free rolls and 5 fire arms and 200 duty free cartridges.

**Sound mangement of Sanctuaries, Parks and Gardens :**

Sanctuaries and national parks constitute an insurance against the total disappearance of the threatened species; so, our offort should be directed to keep these animals well within the boundaries of Parks and Santuaries. Wherever its natural food is found defficient, it should be supplemented by enforcing intense protection and even by breeding and releasing pigs, deers, or Nilgai and also by - growing grasses and creating artificial drinking water holes. A young energetic, enthusiastic and genuinely interested game warden should be appointed to look after them.

**Wild Life Literature:**

We have very few books written about these manificent animals and birds. More and more trainted people should take interest in it and bring forth the glory of "wild life" which will help in furthering the interest in this fascinating subject in the minds of our young generation. A quotation of Mr. S. K. Patil, the Hon'ble Minister for railways is worth mentioning here:

"One who can't love animals and trees he can't love his wife".

Hence 'Tourism' if propoly developed can grow into a tangible industry like tea, or coffee industry and will be able to give a helping hand to the collapsing finance of oun country.

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**(Sd.) M. B. PETER,**
*PRINCIPAL*
*Southern Forest Rangers College,*
*COIMBATORE.*

# Paradoxes of Forestry

X. M. LADISLAUS

1965—67 Ranger's Course

The dictionary meaning of paradoxes is that they are seemingly absurd statements though well-founded on facts. My very first experience in the college consisted of an encounter with a paradox. As I entered the class-room to take my first lessons in Forestry, I found the writing on the board reading, 'Minor excels Major'. This sounded more paradoxical than William Wordsworth saying' " Child is the father of Man ". Later, I understood the terms 'Minor and Major, referred to minor and major forest products respectively.

Any how, sooner I had to come across many more interesting paradoxes· Before proceeding to have a more detailed survey of paradoxes, let us have some paradoxes from the 'Survey'. Everywhere the follower takes orders from the leader; but, here the 'leader' is invariably directed by the "follower" and "the duties of the follower call for greater intelligence" (Ram Prakash). From the days we marched schoolwards with latchets on our shoulders and 'twinkle twinkle little star' on our tongue we have learnt to proceed to achieve the whole, step by step and part by part; but the foremost principle of 'Survey' says we have "to work from whole to part and *not* from part to whole.

From times immemorial men had been spilling blood to get hold of fertile lands; but here the fertile evergreens are considered comparatively uneconomical. These are preserved in virginity for the profit of those agriculturists and plainsmen who simply do not regard our service as anything worthwhile. In the forests, the woods from which 'liquid gold' is mined out flourishes in the driest of the climates and the poorest of the soils.

The 'Naked Maiden of the forest' is paradoxically different from the rest of her kind. When the young girls on earth roam about free of encumbrances, she is compelled by Mother Nature to put on a hard clothing. As she matures and gains legal rights of independence, she strips off her costume and boasts to

her Foresters how beautiful is uncomplimented God's creation. The boast of her innocent immodesty is rewarded by her betrothal to no less a stalwart than Mr. Teak, whence she is affectionately known as Mrs. Ben Teak.

In this world of Forests, as in any other world, we have great comedies and greater tragedies; but inexplicably the greatest of them springs from the least expected source, in the miniature family of lac insects. The male insect, sans eyes, sans legs and sans mouth lives through its destined hours of life, motivated to fulfil its sole duty of assisting God in multiplication. When the aim is achieved the hero dies of exhaustion and starvation — when in the point of expectation he should have begun to lord it over.

It is said that when Sonny Jack thinks of India he remembers only elephants and Chacha Nehru. Truly elephants form the most useful and magnificent majority of the denizens. Unlike the gluttons of humanity, they form part of the disciplined labour—front of our Forests. It is said that these mass of flesh never once slip on slopes and better stil they are said to develop more velocity as they climb up across the contours. The most abhorred fatties prove to be the most amiable children (or childish too, at times). Though childlike, they are the most unfortunate of all male creatures to be tortured by sex pervertions. Once they catch a glimpse of their girls flirting with the other Romeos of their race, you could conclude that the 'black' Othello was slower in action than these animals not so black.

A disciplined social life is the criterion of a truly civilised society. If we examine in this light, we will realise how poor the so-called civilised are and how civilised the wild are. The wild scrupulously maintain the natural order to the alphabets. They never commit anything unbecoming of individual or collective characteristics; but in case of breach of Nature's law, the strict disciplinarians become the worst devastators. That is why, perhaps, the Sages and Rishies, the exponents of ancient Indian disciplin chose forests their above of inspiration and pulpit of preaching. Intelligence was born on the inlands but wisdom was born in the cool sequestered shade of 'Bodhi Vriksha' Happiness may be purchased with tickets; but for Peace of the Divine Order, the hazardous hill-tops have to be climbed, whether it be Badrinath, Madina or Calvary.

There was one, J. B. Priestely, an eminent essayist who lived in Hollywood. He thought of his world and deeply too. Then, that Priestley could only condemn his Hollywood for her false paradoxes; but, I, a tiny Forester, and would be 'Priest of the Forest' commend this jollywood for her happy paradoxes.

# THE SOUTHERN FOREST RANGERS COLLEGE MAGAZINE

ANNUAL JOURNAL OF FORESTRY, SHIKAR AND TRAVEL

The Magazine now forms a section of the Southern Forest Rangers College Association. The Editorial Board has been reconstituted and the Management Rules revised in terms of the Rules of the Association.


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